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Supply Preparedness

Strategy of Personnel Depends Upon Strategy of Matériel

By Hon. Harry H. Woodring*

TO keep this country at peace, it is imperative that we maintain our armed forces in a state of sufficient preparation capable of defending this nation against aggression and thus give it that security which is a potent factor in the maintenance of peace. Peace without adequate security is an illusion impossible of attainment. Peace and security go hand in hand. With them we need not fear for the future of America. The War Department is constantly engaged in defense preparations designed to give this nation a practical security commensurate with its needs as dictated by the activities and developments among the nations of the world.

I have found that most people think of defense in terms of man power and overlook the importance of supply preparedness. It is my purpose to sketch briefly some aspects of this supply preparedness.

The World War had not progressed very far when it was suddenly realized with considerable alarm, by all participating nations, that matériel was a limiting factor in all strategy and operations. They had to acknowledge that industrial organization—the ability to produce necessary supplies—was just as important as men and money. In our own country it was clearly demonstrated that we could obtain men and train them much faster than we could equip them.

Since the World War there has been a universal recognition of the necessity for industrial mobilization as an important adjunct to military effort. This thought was significantly summed up a few years ago by the War Policies Commission appointed by the President under the direction of the Congress, in the following words:

"Modern industrial progress has consequently occasioned a kaleidoscopic change in battle conditions, in spite of the fact that the basic principles of war remain the same from age to age. More and more the soldier has come to depend for his effectiveness upon the skill of the inventor, who designs his weapons, and the work of the artisan, who produces them. . . . Complicated weapons and machines are used up rapidly in war. Armies and navies must not only be well supplied initially—but maintenance must be adequate and continuous. Thus, the success of a modern fighting force is directly and immediately dependent upon the ability of the nation's industrial resources to satisfy promptly its requirements in supplies. In addition, throughout the duration of war the nation must continue to produce all the material things upon which the health and well-being of its population depend. War is no longer simply a battle between armed forces in the field—it is a struggle in which each side strives to bring to bear against the enemy the coördinated power of every individual and every material resource at its command. The conflict extends from the soldier in the most forward lines facing the enemy to the humblest citizen in the remotest hamlet in the rear."

WE are informed through the press that there is today a widespread trend in the nations of the world not only toward rearmament but also toward effective supply and industrial mobilization preparedness. We hear on all sides such questions as, "When will Germany be ready?"—"When will Russia be ready?"—"When will England be ready?" Similar questions are applied to other nations. The answer invariably made is—"They will not be ready until certain features of their economic plans are developed to insure a reasonable supply preparedness." We are told that France is interested in the development of industrial mobilization in all its details with a considerable measure of governmental control. Germany has announced to the world her determined effort to become self-sustaining. A few weeks ago the press carried reports that General Goering was given power to carry out a four-year plan of economic rehabilitation—a plan said to envisage strictest coördination of all forces of the state and Nazi party to make Germany independent of the world. Japan is said to have promulgated a law which regulates the direction of supply of factories and shops and covers the mobilization of the war-equipment industry.

In Italy, under the Fascist régime, it is said that the state has absolute control at all times and can direct the economic activities of the nation in peace or war, and that necessary steps are continually instituted to keep the nation's needs, present and potential, in constant tune with its resources. With the appointment last March of a Minister for the Coordination of Defense, Great Britain has entered upon a formidable program of preparation. The scope of this Minister's jurisdiction is said to include coördination of missions, strategy, and organization of the armed forces, coördination of war-equipment production and other supplies, and coordination of national food procurement and distribution. Similar preparations in various degrees are being made in other nations, putting a premium on the subject of resources and supply preparedness.

In our own country, as a result of the experience of the World War, and by an act and direction of Congress, the War Department for more than fifteen years has been developing plans and personnel for procurement and industrial mobilization toward efficient supply preparedness, in order that we may have the most effective utilization of our country's resources in case of an emergency. In its school system the Army Industrial College occupies a position on the procurement side of the War Department similar to that of the Army War College on the military side. The mission of the

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Army Industrial College is to train officers with a view to insuring adequate knowledge of the nation's needs in industrial organization and mobilization of matériel, and understanding of the technique of supervising procurement of military supplies. Its students study the economic and industrial factors affecting national defense; the difficulties to be met in the production of modern supplies; the principles applicable to modern industrial operations, and the need for mutual understanding between the Army using supplies and the industrial establishments producing them. They survey the entire field of the nation's economic resources and their most effective utilization. They are trained to assist in the technique of organization, management, and the supervision of procurement, and to serve in key executive positions in any control agencies which may be set up.

Unlike the situation which existed during the early period of our participation in the World War, these plans and preparations make possible the determination of the amount of supplies required for an emergency; when the troops may be expected to be equipped; the percentage of industry required to produce these supplies; the cost of the procurement program; how the industrial load is distributed throughout the country; and when and where supplies will become available.

THE resources of our country alone are merely an indication of potential strength. In an emergency they would have to be used to meet all military supply requirements and also to take care of the needs of the civilian population. Although we are blessed with plenty in most essentials, the flow would necessarily have to be changed into different channels, and where shortages occur, proper distribution and use of materials and services would have to be made. It is often said that our country's industrial strength has no peer; that we can produce all our requirements once we set about to do so. That is no doubt true. But what of time—that precious element which can spell victory or defeat? A factory may be able to produce war matériel, but before it can do so changes must be made in machinery and organization. The workmen must be taught the new methods and new technique. Raw materials of a different nature than normally used must be found, purchased, and received. All this takes valuable time and might delay production for a considerable period. Similar conditions would confront many of our industries, so that actual supply of necessary equipment might take from a few weeks to years, depending upon the complexity of the articles to be produced and the degree of change necessary to transform peace-time industry for national-defense purposes.

One of these complex articles requiring a considerable period of time to produce is the airplane. This consideration prompted me to introduce a new airplane procurement policy, now practiced by the War Department, which permits qualified manufacturers to compete for the Government business and at the same time protect the interests of the Government. It also puts a premium on performance, giving manufacturers an incentive to develop and produce the best and most modern planes and thus keep the industry developing in line with the latest thought in aëronautical engineering. This policy is working. Peace-time production is being accomplished to the maximum degree permitted by available funds. We are securing the most efficient military planes in the world at a rate of delivery which offers assurance of the completion of the War Department air program in the not-far-distant future.

In addition to the necessity for peace-time production, the nation must have the air industry so developed in time of peace as to be able to embark on a program of rapid quantity production to meet emergency requirements. Our sad experience in the attempt to produce aircraft in quantity during the World War is not a pleasant memory. Under the War Department's current policy, the scheme of quantity purchases within appropriation limits enables manufacturers to gain experience in tooling in accordance with mass-production principles as contrasted with the hand-produced plane, which experience from a national-defense viewpoint would be most valuable in time of emergency.

To assist the President in controlling our nation's entire assets in the event of war, a high degree of coördination of the entire nation's industrial and economic resources would have to be maintained, and effective means of the control of this coördination established. Toward this end the War Department analyzes plans for the procurement of strategic commodities, prepares and evaluates studies relating to the procurement of critical commodities, and develops control measures for such commodities. It collects information showing requirements for specific commodities, together with data on sources, stocks, substitutes, and statistical trends. It also prepares plans affecting labor, power, fuel, transportation, price control, finance, and public relations. All this is done with the aim to reduce to the minimum the period between the declaration of an emergency and the time when industry could begin mass production of essential supplies, and to develop such a system of industrial control that every essential producer would be assured of adequate amounts of raw materials, power, money, labor, and transportation with a minimum disruption and dislocation of the peace-time structure.

FROM the experiences in the World War and studies made since, it is believed that war-time industrial control could be exercised best through an agency or agencies specifically set up to assist the President.

Plans for such control are embodied in our Industrial Mobilization Plan. They are designed to serve as a guide upon which any agencies created by Congress or the President could build the control of our national resources in an emergency. The Industrial Mobilization Plan is the outgrowth of many years of research, analysis, and study and is believed to be the best thought on the subject developed up to the present time. In its development, the Army, Navy, and industry have been consulted, and there is agreement among them on its basic features.

The great number of articles and the variety of materials that go to equip modern armies are constantly increasing. The carrying of huge stocks of reserves necessary totally to equip a major mobilization is out of the question, not only from the standpoint of expense, but also because of the constant technical evolution which quickly renders equipment obsolete. Therefore, supply preparedness must include first, provisions for carrying only the most essential reserve stocks consistent with reasonable expectations of the peace-time availability of funds, and, secondly, a thorough preparation of supply plans for the mobilization of industries with a view to rapid production in an emergency. And that is the aim of the War Department in its planning for national defense.

Close contact is maintained with industrial, agricultural, economic, educational, and labor leaders and establishments,

and with their generous aid the economic and industrial resources of America are appraised, military supply plans are harmonized with everyday business practice and procedure, and detailed programs for the acquisition of proposed needed supplies and equipment are formulated.

To offset possible misunderstanding, I wish to state emphatically that the plans for industrial mobilization contemplate no thought of control or management of industrial establishments by Army personnel. These plans involve solely a peace-time study of how industry, working in its own way and under its own leaders, can best serve the Government and the nation in a national emergency. The proposed central agencies are designed to be operated by civilian personnel appointed by and responsible to the President, which would control all the industrial and economic elements of the nation necessary in the defense of the country.

The best general in the world cannot defend his country without troops—the best troops in the world cannot defend their country without supplies; and supplies cannot be provided without thoroughly efficient preparation and suitable control machinery covering the whole area from sources of supply to the foremost soldier in the front line. It must be realized, however, that the task of planning for supply preparedness has complexities of great magnitude in our ever-progressive country which sets the world stride in business and industrial development, so that the plans can never be absolutely complete. Yet that is the goal. And they are moving toward completion, and those completed are being periodically revised to keep abreast of developments.

I know that our people abhor war. I also know that the Army, knowing the implications and horrors of war, is a strong advocate of peace. It has no voice in making our laws. It does not shape our foreign policy. It has no voice in plunging the nation into war. It always stands for service to the people whether in peace or war. It is a powerful protective influence acting as a barrier against war.

Likewise, this peace-time study and paper plan of industrial preparedness is not a provocative of war. Our national policy does not permit aggressive militarism with large standing armies and huge military supplies. We want none of that. Rather, our plan for effective industrial preparedness is a further deterrent against war and a signal notice to the world that America intends to be assured of peace.

AFTER twenty years of an avowed hope for peace among the peoples of the world, world conditions today indicate that the dangers of armed conflict still lurk in many quarters. Longing and praying for peace will not alone effect that end. Nothing would so certainly invite invasion of our country as for us to build up our material and spiritual well-being which we now have and then say to the world that we are for "peace at any price"; that we will throw away our weapons and all means of defense, and depend for our security entirely upon the hope that no nation could be so wicked as to launch an unprovoked attack upon a great, though defenseless people.

We are committed to our nation's traditional policy of self-protection.

To be adequately prepared, the War Department is making every effort to inform the Congress of the necessities to bring our air and land forces to a strength commensurate with the minimum requirements of this country for adequate national security. This means that we must have modern aircraft, mechanized and motorized units—in short, a small, efficient, mobile Regular Army, modernized to include the technical military developments which have taken place throughout the world, and augmented by the necessary civilian components. The expense involved is cheap insurance against the price of war. It is a far wiser policy to expend dollars in security than human lives in war.

In the development of our plans for national protection, the American people are entitled to be informed that in a general way we now know the resources of the country and how they can best be utilized; that industry is acquainted with our requirements and knows what it may have to produce; that the War Department has a thorough appreciation of modern supply preparedness and recognizes that in defense preparation the "strategy of personnel" depends as never before on the "strategy of matériel".

EDITOR'S NOTE: In his annual report for the year 1936, Mr. Woodring, as the Assistant Secretary of War, described some of the more important steps in industrial mobilization planning. The following excerpts are quoted from the report, in elaboration of some points raised in the above article which was presented in a nation-wide radio broadcast, November 30, 1936. "I am glad to be able to report that considerable progress is being made in the coördination between the War Department and the Navy Department in regard to the allocation of industrial plants to the respective services for use in a major emergency. As an example, this year an agreement was consummated between the two, settling the question of the allocation of machine-tool plants for war-time procurement. This will permit contact and direct planning in detail for specific types of machine tools. A similar agreement between the two services has been made on a substantial number of other important manufacturing establishments, including those engaged in the production of aircraft—one of the industries most vital to national defense.

"This coördination between the Army and Navy, so essential in producing a comprehensive plan for war-time procurement and one which will fit the needs of the two services, is being secured under the auspices of the Army and Navy Munitions Board.

"The increasing recognition of the importance of raw materials in national defense was reflected during the year in the enactment by the Congress of a law which prohibits the export of any tin-plate scrap, except upon license issued by the President. The primary purpose of the act is to assure, in the interests of national defense, the continued operation of the detinning companies of the country. Practically the entire normal supply of virgin tin is imported. There is, however, a detinning industry which in 1931 recovered tin equal to twenty-seven per cent of the virgin tin imported in that year. The secondary tin is recovered from the scrap that results from the manufacture of tin-bearing articles and from junk containing tin. In time of war, when imports are difficult to obtain, the detinning industry would constitute an important source of supply of this strategic war material. In addition, there was introduced in Congress a bill which would provide for acquiring stocks of ferromanganese ore, chrome ore, tungsten ore, and pig tin for war reserves. When Congress adjourned this bill had not been reported out by the committee to which it had been referred. The interests of national defense will be decidedly enhanced by passage of this bill and by controlling the exportation of tin scrap."

Naval Warfare Tomorrow

A Well-Balanced Fleet and Ship-Borne Aircraft the Best Policy

By Hector C. Bywater*

THERE is a striking parallel between the circumstances which influence present-day thought on naval tactics and strategy and those that prevailed in the closing decades of the nineteenth century. Today, just as fifty years ago, the advent of new weapons of a potency apparently unlimited but not yet fully tested, tends to confuse thought and darken counsel. During the eighties of the last century the naval mind was bewildered by the comparatively sudden revolution in tactics which appeared to have been effected by the introduction of the locomotive torpedo.

Naval thinkers as a whole were still obsessed with the lessons—wrongly interpreted, as we now know—of the Battle of Lissa, in which the ram was supposed to have played a decisive part. For more than thirty years afterward, that action left its impress on naval construction in the form of the ram bow with which practically every battleship and cruiser of those days was equipped. In many navies certain ships were specially designed to act as rams (*e.g.*, the U. S. S. KATAHDIN, H. M. S. POLYPHEMUS, etc.), and in all fleets the steam manœuvers necessary to establish such close contact with the enemy as would bring the ram into play were assiduously practiced.

The torpedo was regarded as an additional reason for designing and training fleets for "all-in" fighting. The rôle of the torpedo boat, as defined by contemporary naval critics, was to wait until the opposing squadrons were locked in close combat and then rush into the "dog fight" to deliver their torpedoes at point-blank range. It is a singular fact that this almost universally accepted picture of squadron warfare as a confused mêlée at close quarters should have been drawn at a time when the heavy naval gun was being developed out of recognition and had already become a long-range arm of precision. Even during the eighties, there existed rifled breech-loaders up to 16-inch caliber which, given efficient sights, would have been effective up to a range of several miles and could drive their ponderous projectiles through all but the thickest armor plate then carried afloat. Naval ordnance had, in fact, already entered upon that process of evolution which seemed destined to make it the absolutely decisive factor in sea warfare, as indeed many, if not the majority, of naval students believe it still to be.

Yet, as we have seen, tactical ideas of fifty years ago were dominated not by the gun but by more novel and therefore more fascinating weapons, such as the ram and the torpedo. Novel in point of chronology the ram was not, since it had been freely employed in the sea combats of remotest antiquity. Its newness lay in the fact that it was now to be used by power-driven ships which, in theory at least, could employ it with far greater certainty and effectiveness than the beak-prowed oared galleys of old.

This mental confusion on the subject of naval tactics persisted well into the nineties. Gradually, however, the continued progress of heavy naval ordnance and the concurrent advance in marine engineering restored the large man-of-war to its true function as a floating gun platform, and led to the recasting of naval tactics on the basis of long-range artillery duels.

THE parallel to which I have alluded is furnished by the sweeping claims now put forward by the partisans of air power. In every country, but more particularly in Great Britain and the United States, air propaganda has been carried to such lengths that doubts have been raised in the public mind as to whether the larger men-of-war, such as battleships and cruisers, are any longer necessary for purposes of national defense. There is, however, an important difference between the situation of fifty years ago and that which now obtains. During the eighties, confused and disordered thinking on the subject of naval tactics was prevalent mainly among naval officers themselves, while the lay public held aloof and waited for the experts to settle their differences. Today, on the other hand, the position is reversed. The doom of battleship and cruiser and their complete supersession by aircraft is proclaimed most loudly by people whose knowledge of naval strategy and its governing principles is obviously negligible.

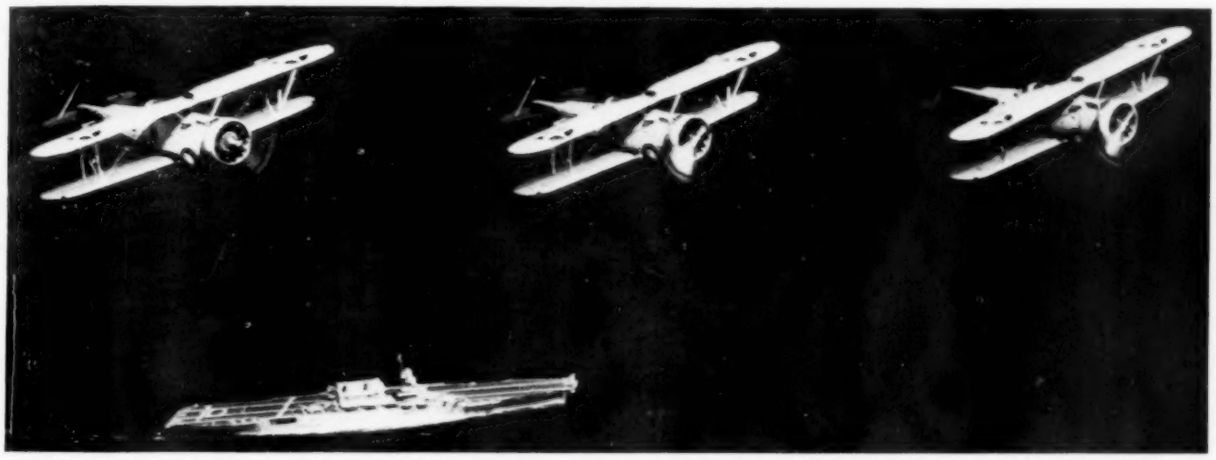
So far, at any rate, professional naval opinion as a whole declines to be stampeded into a recantation of its orthodox views and bears witness to its unshaken faith by continuing to build warships on more or less conventional lines. This attitude is, of course, denounced as hidebound conservatism by the air partisans, the most vehement of whom are people who have no personal responsibility for the defense of their respective countries. Their patriotic motives are beyond question, but I venture to assert that in seeking to overthrow an old-established and well-tried system of naval defense and replace it with a new and as yet unproved air armada, they are gambling with national safety.

Writing elsewhere in this connection two years ago, I expressed the following views which it may be apposite to quote here: "Owing to their vital importance, all questions relating to national defense demand cool and sober judgment, unaffected, so far as is humanly possible, by prejudice, fad, or fashion. Those who express extremist views on this subject should pause to consider the consequences that would ensue if their views were put into practice, and, when an emergency arose, found to be fallacious. It is easy to perceive that an untrammeled enthusiast armed with plenary power, might, with the best will in the world, plunge his country into destruction. Doctrinaires, fanatics, and men possessed by a single idea may, if vested with authority, prove more dangerous than a foreign foe."

Notwithstanding their reputed conservatism, the naval authorities of most countries are actively developing air power and applying it to the needs of maritime tactics and strategy. The possibilities of aviation are, I believe, recognized quite

*Author: "Sea Power in the Pacific," 1921; "The Great Pacific War," 1925; "Navies and Nations," 1927; "Their Secret Purposes; Dramas and Mysteries of the Naval War," 1932; "A Searchlight on the Navy," 1933. Coauthor (with Sir Archibald Hurd): "From Heligoland to Keeling Island," 1914; "Fleets at War," 1915; (with H. C. Ferraby): "Strange Intelligence; Memoirs of Naval Secret Service," 1931. Translator: "Spies Break Through; Memoirs of a German Secret Service Officer," by Lieut. A. Bauermeister. Naval correspondent in Germany of the Navy League, *Naval & Military Record*, *Pall Mall Gazette*, *Daily Graphic*, etc. European naval correspondent, Baltimore *Sun*, 1921-1930.

as clearly by sailors as by the most fervent air champions. At the same time, as practical seamen, they perceive the inherent limitations of aircraft when employed at sea—limitations which are hidden from the critic ashore who knows the sea only from gazing at it or from flying over it within easy reach of the coast. Every sailor knows that aircraft in their present stage of development are quite incapable of playing any part whatever in warfare on the high seas unless they operate from ocean-going ships. In narrow waters, such as the English Channel and the central region of the Mediterranean between Italy and Africa, aircraft might conceivably engage warships on equal or superior terms and establish tactical command, in daylight, over a restricted area of sea. It is when we turn from prospective operations in narrow seas to survey ocean strategy that the limitations and disabilities of air power become manifest.



Official Photo: U. S. Navy

AIRPLANES OF THE U. S. NAVY OVER THE AIRCRAFT CARRIER LEXINGTON

THE claim advanced by air enthusiasts that their favored weapon has already become an effectual substitute for naval power in all circumstances can be subjected to a simple test. Let us cast our minds back to the closing months of 1914 when there had developed in the Pacific a situation which caused the British Admiralty grave concern. A powerful German force under Admiral Count Spee had met and defeated off the Chilean coast the only effective British squadron in the Eastern Pacific, under the command of Admiral Sir Christopher Cradock. Germany, therefore, had gained local command of the sea and was free to exploit her advantage as she thought best.

Admiral Spee could either have rounded the Horn and preyed on the vitally important South Atlantic trade routes, or he could have taken his squadron to South Africa and coöperated with his countrymen in "German South West." In either case it lay in his power to inflict immense moral damage on the Allied cause, and unless he were promptly brought to book the mischief done might be incalculable. We know how the British Admiralty met the situation and retrieved it by a combination of good judgment, swift action, and amazing luck. Two battle cruisers, secretly dispatched from England, reached the Falkland Islands only a few hours before the German squadron arrived there, and in the ensuing action all save one of the German cruisers were destroyed by the two ships which lay in wait for them.

Let us suppose that a similar situation arose today, but that in the interval Great Britain had scrapped all her big men-of-war and intrusted her air force with the protection of her trade routes. News is received that two hostile capital ships are in the vicinity of the Falkland Islands, whence they are likely to play havoc with British shipping in the Atlantic and utterly dislocate trade in that area. How could such a menace be countered and overcome by air power alone? The only means of conveying aircraft to the danger zone would be by means of ships, and the largest aircraft carrier is no match for a cruiser, let alone a capital ship. Moreover, if the carriers encountered the enemy in weather conditions which made flying impossible, they would be shot to pieces without having a chance to defend themselves.

Even if the enemy were sighted under favorable conditions, the effect of an attack by planes on large, well-armored ships amply provided with antiaircraft batteries must remain problematical. The fact that the situation here pictured actually deveoped during the World War justifies us in selecting it as a test case.

I do not believe that any unbiased judge will deny that air power alone, unsupported by adequate naval force, would be wholly incapable of coping with a strong squadron of warships or even with individual raiders above the light-cruiser category, anywhere beyond a few hundred miles from shore airdromes. It is only because the air champions persist in ignoring such wastes of water as the Atlantic and the Pacific and in concentrating their attention on the narrow seaways, that their dangerous heresies become plausible to the lay public.

It is, however, scarcely to be doubted that air power would play a prominent and possibly a decisive part in a naval campaign confined to European waters. The recent tension between Great Britain and Italy has led to important changes in British naval policy which are due very largely to the threat of air attack. Many, though by no means all, British naval officers believe that the overwhelming superiority in air force which Italy could have brought to bear in the middle and eastern Mediterranean would have rendered that region untenable for British warships, besides compelling Britain to abandon the Mediterranean mercantile traffic route to the East.

The decision to create a new fleet base at Alexandria is a

direct sequel to the Italian air threat against Malta, which is only seventy miles from the new airdromes in Sicily. Future naval operations in the English Channel and the North Sea promise to be influenced by air power, since the increasing range of aircraft has brought most of the Channel and the North Sea, together with all the British dockyards located there, within effective striking range. Nevertheless, there has not yet been any development in aviation which would justify a modification of British naval dispositions in the Atlantic or the Pacific, except in so far as Hongkong may be considered to have declined in strategic value by reason of its vulnerability to attack from Formosa and the mainland.

TO all appearances, the naval strategy of the United States is even less likely to be modified as the result of progress in aviation. It is difficult to see how the paramount naval problem confronting the United States, namely, maintenance of strategic control over the Eastern Pacific and security of communication with the Far East, including the Philippines, can be either complicated or simplified by the development of air power. Here we have a potential zone of operations where distances are so enormous that the cruising radius of even the largest men-of-war is deemed inadequate. Unless operating from floating bases, aircraft are, and bid fair to remain, absolutely powerless to solve any problem arising out of Pacific strategy.

In my opinion, expressed with all diffidence, it is not hidebound conservatism but a clear-sighted appreciation of actualities which impels the United States to develop its naval power on the principle of a "well-balanced fleet." An overwhelming case can be made out for building and maintaining a strong force of capital ships with proportionate quotas of heavy and light cruisers, destroyers, and submarines. For the concurrent and energetic development of air power as an ancillary arm of the U. S. Fleet there can be nothing but praise.

At this writing, both Britain and the United States are about to lay down new battleships, and it will be interesting to see in what manner their designs reflect modern doctrines of strategy and tactics. From hints dropped in London and Washington it seems probable that the new ships will show a marked advance in speed over their predecessors. Hitherto the American Navy has built only battleships of moderate speed, mounting the heaviest possible battery and carrying exceptionally robust armor protection. The production of a fast battleship would therefore represent a landmark in American naval policy. The strategic and tactical value of speed has long been a subject of controversy, but so far as Europe is concerned, it seems to have been tacitly agreed that the future capital unit must be a combination of battleship and battle cruiser—an armament of at least nine heavy-caliber guns being associated with the best possible defense against gunfire, overhead and underwater attack, and a speed of not less than thirty knots.

Turning to cruisers, much interest has been evoked in British naval circles by the news that American opinion has been "converted" to the 6-inch-gun cruiser. Eighteen United States vessels mounting an 8-inch battery have been built or laid down to date, and it is understood that even without the 6-year ban imposed by the new London Naval Treaty, no further ships of this type would have been started in the near future. It would be instructive to learn the reasons responsible for this change in cruiser policy. From the viewpoint of ballistics, the 8-inch-gun ship possesses an enormous advantage over one armed with 6-inch guns, for the 8-inch gun is not only more accurate at long range, but the explosive power of its projectile is nearly thrice as great as that of the 6-inch. Probably the principal reason for the decline in popularity which the 8-inch cruiser has suffered is its vulnerability. As long as the qualitative limit of 10,000 tons remains in force it is impossible to endow a cruiser armed with eight or more 8-inch guns, and engined for a speed of thirty-three knots, with armor capable of resisting guns of even moderate caliber. Furthermore, such a ship is notoriously sensitive to torpedo or mine, as the powerful propelling plant leaves very little space for subdivision. In British eyes, the new American 6-inch cruisers appear to be overloaded with armament, and it is considered that the restriction of the battery to twelve guns instead of fifteen would have yielded a better margin for protection. On the other hand, it is recognized that in sacrificing other characteristics to weight and volume of gunfire, the American authorities are merely carrying on the unbroken tradition of their service.

The new American destroyer program, with its well-balanced proportion of 1850-ton flotilla leaders to the standard 1500-ton destroyer type proper, seems admirably adapted to the requirements of oceanic strategy, since the new vessels have a high degree of seaworthiness in conjunction with a generous radius of action. Having regard to the special problems confronting the United States Navy, it is rather surprising that the building of long-range, ocean-going submarines has not been undertaken on a greater scale, for it is easy to visualize circumstances in which a large contingent of such vessels would prove of inestimable value.

In numbers and modernity, the U. S. aircraft carrier squadron is unmatched, while America has also led the way in equipping her capital ships and cruisers with multiple aircraft. As a result, an American fleet going into action on the high seas would possess a pronounced superiority in air power over any other opponent, and it is quite on the cards that, *in these circumstances,* air power might exert a decisive influence on the issue of battle.

The late Marshal Foch is credited with the dictum that the next war will begin where the last one ended. This may well be true of land operations in which tanks, other forms of mechanization, chemical warfare, aircraft, and the great increase in fire power due to the introduction of automatic small arms may revolutionize tactics. But when we turn to the naval field it is difficult to discover any new factor other than air power that promises to effect a drastic change in fighting methods. And the exceedingly limited influence exercised at sea by aircraft operating independently of ships has already been demonstrated.

There is thus no present reason to suppose that a future oceanic campaign would present features differing markedly from those of the past. That the issue will be determined by a full-dress action between the opposing battle fleets is, in my opinion, more than likely. Further, apart from the unknown quantity represented by ship-borne aircraft, there is nothing in the current trend of naval technique to indicate that heavy artillery will be superseded as the decisive weapon. The conclusion, therefore, seems justified that a policy of developing and maintaining a well-balanced fleet in conjunction with the strongest possible force of ship-borne aircraft—a policy which the United States in particular is pursuing with admirable consistency and energy—is the soundest one in the circumstances, and the best one to promote national security.

Effective Neutrality

Legislation Alone Is Not a Substitute for Preparedness

By Walter Lippmann*

SENATOR VANDENBERG, like most of us, would be glad to find a policy that is automatic, fool proof, and guaranteed to keep the United States out of another great war. I wish I could believe that such a policy can be invented. For it is plain enough that if a European war breaks out, it will be so devastating that for generations to come Europe will be living in another Dark Age. In view of that prospect the highest obligation of this country is to see that this hemisphere remains at peace, providing a sanctuary for the heritage of civilization.

But if we are to succeed in that purpose, we must not begin by flattering ourselves that it can be accomplished by the simple and easy device of passing some new statutes. To remain at peace while the world is at war will require much more than a few laws prohibiting this and that. It will require continual action that is vigilant, resourceful, resolute. It is for action of that kind that we ought to be preparing ourselves, never allowing ourselves to fall into the comfortable delusion that when we have passed some laws we shall have made ourselves secure.

It is, I think, easy enough to demonstrate that no workable statute of the kind Senator Vandenberg wants can possibly be devised now. He would like a statute which definitely prohibits certain kinds of trade and intercourse with nations that are at war. The task of defining now, in advance, how much of each commodity we would be willing to sell to each possible belligerent in two groups of allies is beyond the wit of man. Suppose, for example, that Britain, France, Belgium, Czechoslovakia, Turkey, and Russia are allies. Can any statute be written this winter which says what the quota of each commodity to each of these nations would be? Can it say also whether Turkey and Czechoslovakia may assign their quotas to Britain and France, or vice versa?

So it would be easier to prohibit all trade with all belligerents. At least it would seem easier. But neutral experience shows clearly that that would be no solution. For there are always the other neutrals. Are we also going to prohibit all trade with other neutrals, or are we going to put the other neutrals on a quota? Are we to refuse to trade with Holland, Sweden, and Switzerland, or do we also put them on rations? And if Japan is neutral, do we prohibit trade with Japan if neutral Japan begins to buy our goods on a large scale for sale to neutral Holland which resells them to a belligerent?

The theory of the "quarantine" is, I am convinced, based on a failure to grasp the complexity of international trade in the modern world and on a misreading of our experience in the last war. Senator Vandenberg, after his service on the Nye Committee, has joined those who believe that we were drawn into the Great War because of our huge war trade with the Allies. Though I think there are good reasons—moral, social and economic—for not permitting such a great war trade financed by credit and loans to develop again, I do not believe that it was the war trade which brought us into the war.

I believe we were drawn in because our own military power was negligible and because the German General Staff made the miscalculation of thinking that we would not and could not develop enough military power to play a decisive rôle. In other words, I believe that Wilson was forced to go to war, not because he failed to follow Bryan's advice, but because he waited too long before he followed Theodore Roosevelt's advice. If he had begun to mobilize after the LUSITANIA, Germany would not, I believe, have dared to declare unrestricted submarine warfare two years later. It was the two years' demonstration that we were not preparing to fight which made it seem a safe gamble to let the submarines loose.

I KNOW that this is not the orthodox view today. But none the less I think it is the true view. And from it I draw this moral: that the only effective neutrality is a highly armed neutrality. So it does not seem to me important, or even feasible, to say in advance just what rights we shall renounce, what rights we shall try to uphold. Those questions will have to be determined when we see the practical situation of the war itself. But what can be done in advance is to prepare all the plans for a highly armed neutrality. Then, on the outbreak of a foreign war we shall be in a position to make sure that the belligerents respect the neutral policy we do adopt. For then, as they grow weaker, we shall be growing stronger; as they, in their weakness are tempted to more and more desperate courses of action, it will be more and more dangerous for them to provoke us, because we shall be more formidable.

No doubt this is an unpleasant proposal. But let us not deceive ourselves into thinking that in a world war we can remain at peace by the simple device of staying at home and folding our arms. What I am suggesting ought particularly to commend itself to those who, like Senator Nye, wish to cut off all trade with belligerents. For their program means immediately a severe depression in the United States. That depression will have to be met by some kind of public work, and with the world in flames, the only prudent kind of public work would be to develop the military power of the U.S. . . .

Finally, and this is no small help in the preservation of peace, it provides useful and patriotic work for those who would otherwise be the leaders and the rank and file of a war party. If Senator Nye remembers 1915 and after, he should realize that the effective propaganda for American intervention came not from the Allies, and not from bankers and munition makers, but from Theodore Roosevelt, Leonard Wood, and their disciples who were clamoring for military preparedness.

So in the next war, we should at the outset go on a war footing in order to preserve neutrality. We should go on a war footing before the war hysteria breaks out. We should go on a war footing before a war party is organized. This is, I believe, the only prudent and effective way to remain neutral, at peace with ourselves, and reasonably sane.

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Machine Guns

Their Development, Limitations, and Future Demands

By Laurence V. Benét*

IN responding to the invitation to present this article in ARMY ORDNANCE I do not propose to go into the detailed history of the machine gun or into its mechanical details as this would carry me too far. So I shall limit myself to a succinct review of its development, and of certain characteristics of the more modern automatic weapons.

Few readers will remember that in the early 1870's the Office of the Chief of Ordnance of the Army was in the Winder Building at the corner of 17th and F Streets in Washington, D. C., and that the Ordnance Museum occupied two stories of a building in the interior court. Here was exhibited a collection of arms and ammunition dating from the Civil War, and, incidentally, the Confederate battle flags captured by the Federal armies. Among the arms exhibited were a "Coffee-Mill Gun", a "Requa Battery" and a six-barrel, caliber .50 Gatling. As a youngster I became deeply interested in these three weapons, which were patiently explained to me by the attendant, a former enlisted man whom I recall as "full of strange oaths and bearded like the pard."

THIS article presents the views of one who has been identified with the successful development of machine guns for more than half a century. His discussion, based on ability and experience, may be said to represent the best thought of the present day on the characteristics and future advancement of a type of weapon which has modified tactics and the entire art of defense more than any one factor other than the airplane. ARMY ORDNANCE, *in publishing this article, herewith makes deep acknowledgement to its distinguished American author whose place among designers and builders of automatic arms is second only to the esteem in which he is held by all students of ordnance.*—EDITOR.

This was my first experience with machine guns. Without going into the details of their mechanism, it should be noted that those three guns were all mounted on field carriages derived from the carriage of the 12-pounder Napoleon gun, were inferior in range, and equivalent in visibility and mobility to field artillery. They represented the development of machine guns at the end of the Civil War.

It was at about this time that the French developed the Montigny mitrailleuse, and by order of Napoleon III a large number were constructed in great secrecy. These were carefully stored, to be sprung upon an unsuspecting enemy on the outbreak of war. The multiple barrels were grouped in a bronze casing. Carriage and limber were of field-artillery type and they were maneuvered with teams of from four to six horses. They proved a great disappointment as they presented excellent targets and were promptly destroyed by the Prussian artillery firing from beyond their range. The army was, in general, unfamiliar with their mechanism, and untrained in their use. On one occasion, however, near Mars-la-Tour, a Prussian regiment was caught in a sunken road, and practically annihilated by a section of these mitrailleuses. Such was the disappointment over the results of this machine gun in actual combat, that for many years, the very word "mitrailleuse" was anathema for the French Army.

During the twenty years following the Franco-Prussian War, two machine guns, the Gatling and the Gardner, were highly perfected, and the latter was used effectively by the British during their numerous colonial wars. It should be noted, however, that generally they did not have to contend with artillery.

In the Spanish-American War, the American Expeditionary Force made no provision for machine guns, but there was one enthusiastic officer, Captain Parker, who managed to get a section of four Gatlings into action at Santiago. This section was brilliantly handled, and largely contributed to the success of the assault on the Spanish works at San Juan. Even at this late date, Captain Parker's book, "The Gatlings at Santiago," is well worth reading.

TAKING the Gatling as a type, it may be noted that in its final development it comprised ten barrels, each with independent firing mechanism, breechblock and extractor. The maximum rate of fire was about 1000 rounds per minute, or 100 rounds per barrel, and consequently the mechanism was not subjected to excessive stress. Using as they did, black-powder ammunition, the relatively light barrels were rarely overheated and water cooling was quite unnecessary.

Two machine guns for naval service were developed at this time to meet the danger of torpedo-boat attack: the 4-barrel, 1-inch Nordenfelt, and the 37-mm. Hotchkiss revolving cannon. The Nordenfelt was adopted by the British Navy, the Hotchkiss by most of the other great naval powers. These guns differed greatly in type. The former, firing solid bullets, was operated by the forward and backward movement of a lever and delivered four-round bursts for each double movement. Of necessity, the mounting of this gun was provided with elevating and training gear, a disadvantage against a moving target, and especially when the ship was in a seaway.

The Hotchkiss 37-mm. revolving cannon presented several interesting features. The Treaty of St. Petersburg having limited the weight of explosive projectiles to a minimum of 450 grs., Hotchkiss adopted a weight of 455 grs., and the caliber of 37 mm. was derived from this weight. The caliber of 37 mm. persists to this day, although the weight of the modern projectile greatly exceeds the original 455 grs. The crank-operated machine gun comprised five barrels revolving in contact with a breech housing or receiver which contained a single feeding, firing, and extracting mechanism. The mounting consisted of a simple fork-shaped pivot, and the gun was pointed by means of a shoulder piece and hand grip. The maximum rate of fire was eighty rounds per minute or

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sixteen rounds per barrel; a barrel never became overheated. A comparatively small number of these guns were adopted for land service by various countries. But, mounted as field artillery, they had all the characteristics of field artillery without its range and power.

A rather curious development of this machine gun was employed largely by the French for flanking the ditches of permanent fortifications. The five barrels were rifled each with a different pitch, and the ammunition comprised cannister of hardened lead balls. Each barrel gave a different spread to the cannister and the rifling was so designed that a series of five rounds completely covered the width and the length of the ditch to be defended.

In the eighties, Hiram Maxim, a Maine Yankee, devised and produced the first single-barrel automatic machine gun, and must be recognized as the father of the modern machine gun. It is interesting to note, however, that Henry Bessemer, in the fifties, secured a patent for utilizing the energy of recoil for automatically loading and training seacoast artillery. He may perhaps be considered the first to have conceived automatic weapons. The Maxim machine gun, as is well known, is recoil-operated, belt-fed and water-cooled. In the case of recoil-operated machine guns it is necessary to reduce the weight of the barrel to a minimum, and for continued fire at or exceeding 500 rounds per minute, water cooling, with all its disadvantages, becomes a necessity. Maxim also patented a gas-operated gun, but, strange to say, he imagined that the bullet and powder gases passing with high velocity over a gas port, would create a vacuum in the underlying cylinder, and draw the motor piston *forward*. Needless to say, a gun on this system was never constructed successfully.

Maxim guns of 37-mm. on the recoil system, popularly known as "Pom Poms" were extensively used by the British during the Boer War. Mounted as field artillery and having low velocity and limited range, they proved of little value when faced by the Boer artillery.

In what has preceded, I have attempted to demonstrate the futility of machine guns in actual combat, when mounted and maneuvered as field artillery.

The eighties also saw the advent of smokeless powders, and this was the end of hand-operated guns. It was found that smokeless-powder ammunition was subject to hangfires, that is to say, from time to time there would be an appreciable interval between the firing pin striking the primer and the deflagration of the charge. The action of a hand-worked mechanism being continuous it would occur that a hangfire cartridge would explode when partially or fully extracted, with disastrous effect on the mechanism of the gun and even on the gun's crew. An automatic stop, on the inertia principle, was applied to the 37-mm. revolving cannon to obviate this danger, but, although it proved effective, it was but a makeshift, and the automatic system came into its own. Even in the most modern ammunition, hangfires still occur, and at rare intervals a slight break or hesitation may be observed in the rattle of a machine gun: this is a hangfire, but the automatic gun "waited" for the cartridge to explode.

AUTOMATIC machine guns may be roughly divided into three classes: 1. Recoil-operated and water-jacketed, such as the Maxim and the Browning; 2. Gas-operated, air-cooled, such as the Hotchkiss and the Praga; 3. Blow-back, either water- or air-cooled, such as the Schwarzlose and Oerlicon.

In the first type, the barrel is of necessity relatively light, the recoil energy—especially in the case of rifle-caliber—being limited and in certain cases insufficient alone to operate the mechanism. Guns of this type can be operated only for short bursts if water is lacking. On the other hand, if water is available, long uninterrupted firing is possible, should this ever be necessary.

Although gas-operated small arms had been proposed as far back as the sixties, the first gas-operated machine gun of which I have knowledge was brought to the attention of the Hotchkiss Company in 1893 by an Austrian cavalry officer, Baron Odkalek. His model gun was a very crude affair, capable of firing not more than a dozen or so rounds without a breakdown. However, the idea was there, and the possibility of developing an efficient weapon. His patents were acquired for a very considerable sum, and from them was developed the well-known Hotchkiss system of automatic arms.

In this gas-operated class, the barrel, being fixed to the receiver, may be given any reasonable weight, and the heat, up to a certain point, is absorbed by the mass of metal of the barrel. It has been observed that under conditions of combat, a machine gun rarely is called upon to fire continuously more than a few hundred rounds, and the barrel cools or may be cooled during the intervals of fire. In general, a spare barrel forms part of the equipment of such guns, and barrels may be changed in the field in a few seconds. In my own experience I have never heard of a barrel being changed in actual combat.

The rate of fire of machine guns of rifle caliber varies but little with the type of mechanism, and is normally about 500 rounds per minute; in machine rifles, with lighter moving parts, it is from 600 to 650 rounds. Whilst these rates of fire are of great advantage in certain phases of combat, it has been considered desirable to be able to reduce this rate, at will, to about 300 rounds in order to avoid waste of ammunition and overheating of the barrel, and to assure more accurate pointing of the gun. Many devices have been proposed and experimented to this end, but only one, to my knowledge, fulfills the rather difficult requirements. This is the Suter device, designed by the present chief engineer of the Hotchkiss Company. It consists simply of an auxiliary sear controlled by a metallic disc actuated by a light coiled spring. As the breechblock recoils, the disc is rotated through a small angle, releasing the auxiliary sear which prevents the forward movement of the breechblock. The disc returning to its primitive position under the influence of the spring, retracts the auxiliary sear, and the operation of the mechanism continues. The moment of inertia of the disc about its pivot is so adjusted that the forward movement of the disc requires approximately one inch. This device is practically frictionless and is unaffected by the angle of elevation or depression. The rate of fire may be changed from 300 to 500 rounds per minute or the reverse, instantaneously.

In the earliest tests of the Hotchkiss machine gun in 1895, I found that the barrels were destroyed after a relatively small number of rounds, and I realized that a mass of metal was required toward the breech end to absorb the heat generated. Then a brilliant idea struck me. Why not form this mass of metal with fins and call it a radiator, although the radiating surface would only be about doubled and of little effect? I applied for a patent in the United States and the examiner promptly cited a patent for the same device and for the same purpose, granted Norman Wiard at about the time of my birth! The records of the Ordnance Department will dis-

close much of interest about Norman Wiard and his inventions. For many years he was a thorn in the flesh of the Department.

The third type, the blow-back, generally has a fixed barrel, and the relatively heavy breechblock is neither locked to the barrel nor to the receiver. The head of the cartridge bearing upon the breechblock blows it to the rear against a returning spring, thus operating the mechanism. The time necessary to overcome the inertia of the breechblock and mechanism is sufficient to limit the movement of the cartridge case until the pressure of the powder gas practically has been exhausted. In guns of this type, it has been found necessary to lubricate the cartridges to prevent transverse rupture, a grave objection at all times, and especially when the gun is exposed to low temperatures.

In all machine guns, and especially those of the fixed-barrel type, the problem of developing a satisfactory barrel steel has occupied metallurgists and engineers for many years. The problem has been complicated by the fact that the best composition of the steel and the best heat treatment depend largely on the type of powder and bullet jacket of the ammunition employed. The profile of the rifling and the form of the forcing cone have likewise great influence on the resistance of the barrel. Firing under combat conditions, a rifle-caliber machine-gun barrel should resist from 40,000 to 50,000 rounds, a machine-rifle barrel from 25,000 to 30,000 rounds, and a cliber .50 barrel 10,000 rounds. There will, of course, be considerable losses in initial velocity as the barrel wears, but the accuracy is affected little, and corrections in elevation for range may be made readily by appropriate sight setting.

THE most intensive development of machine guns in recent years has been for the armament of aircraft and for antiaircraft defense. For the former service, the problem has been particularly difficult. Two types of gun have been required: the synchronized and the nonsynchronized—the latter either fixed or free. In both types, lightness and high speed of fire are prime requisites. In rifle-caliber guns, a speed of fire of from 1000 to 1200 rounds per minute is attained, and when it is realized that the mechanism must perform, unerringly and in sequence, the operations of feeding, loading, firing, extracting and ejecting in one-twentieth of a second, it will be seen that every resource of metallurgy and mechanics must be called into play to produce an efficient and dependable weapon. I recall that in the case of an otherwise perfectly satisfactory synchronized gun, over two years were required in experimentation to produce a firing-pin spring that would not fail. The mechanism of the nonsynchronized gun is a far simpler problem, and happily for the peace of mind of the constructor, the synchronized type is fast disappearing.

In the higher calibers of aircraft guns, ½-inch, 1-inch and 1½-inch, other problems arise: first of all, weight, which must be reduced to the minimum, and secondly, the recoil stresses which must be adjusted to the structural resistance of the airplane. The latter problem has been fairly well solved by the application of hydraulic brakes.

Machine guns of 1-inch, 25-mm. caliber, and above, fire explosive shell almost exclusively, and with the newer explosives their effects, even on the wings of an airplane, are fairly conclusive. It has been necessary to develop, for these small projectiles, a supersensitive fuze acting instantaneously when traversing the fabric of a wing and exploding automatically after a flight of about two seconds. Automatic destruction readily may be obtained in combination with a specially designed tracer container, and is a necessity to avoid casualties among friendly troops. Several types of such fuzes have been produced successfully and are in actual service.

It appears to me that many existing difficulties would disappear were airplanes designed, as are all naval vessels, with the prime object of carrying into action a given armament. Up to the present, the problem largely has been reversed, and it is required to adapt the armament to independently designed airplanes. Close collaboration between aircraft designers and armament engineers should lead to great improvement. As has been well said, "It is difficult enough to dance well, but to dance in chains is well-nigh impossible."

For defense against low-flying airplanes, machine rifles and rifle-caliber machine guns, with or without correction grids, can be used effectively and have the advantage of being brought into action instantly and without special preparation. The modern machine-gun tripod generally is provided with means of raising the gun for high-angle fire and of firing in any direction without moving the tripod. Very special training is necessary for effective fire against low-flying planes, and without this, the best defense is a hasty search for cover!

It is generally admitted that antiaircraft artillery, with time-fuzed projectile, cannot be used effectively at ranges much under 2000 yards on account of the rapid angular displacement of the target. Within this range the artillery is generally supplemented by machine guns of ½-inch, or 13.2-mm. caliber. The mechanism of these guns is, in general, similar to those of rifle caliber. Simple tripods arranged for high-angle fire or light infantry wheeled carriages which may also be used for defense against light tanks are now in rather extended use. These guns, mounted singly, are provided with correcting grids. They are pointed directly from the shoulder, being disengaged from elevating and training gear when in the position for high-angle fire. The speed of fire of these guns is about 450 rounds per minute, but in many services, especially the French, the guns are mounted in pairs, and the rate of fire per unit becomes 900. These latter mountings are fitted with quick-acting elevating and training gear. The gun pointer is seated and can fire the guns alternately or together by means of pedals, both hands being free for operating the elevating and training gear. A rather elaborate corrector is fitted on the mounting, and gives automatically the corrections for range, elevation, speed and course of the target, time of flight, wind, and variations in speed of airplane when climbing or diving. Auxiliary instruments, such as telemeters, altimeters, predictors, etc., are required, and such guns are, in general, employed for fixed or semifixed positions or mounted on trucks, trailers, or armored cars. The effective vertical range is about 10,000 feet, and the armor-piercing bullet will traverse a 20-mm., .8-inch plate, Brinell hardness 500, at 500 yards. For naval service, the 13.2-mm. gun on quadruple mounting is used extensively and will deliver rapidly succeeding bursts at the rate of 1800 rounds per minute.

Antiaircraft machine guns of 20-mm., 37-mm., and 40-mm. are in actual service both ashore and afloat and are being extensively experimented on aircraft. The mechanism is, in general, derived from machine guns of rifle caliber, differing principally in the details of the firing gear. To insure stability and to reduce the stresses on the mounting, the guns are permitted recoil of a few calibers, controlled by hydraulic brakes with spring return. The first round is, of course, fired

with the gun fully in battery, but in automatic action, subsequent rounds are discharged a caliber or so from the in-battery position, the recoil being overcome partly by the hydraulic brake, partly by the momentum of counter-recoil. By this arrangement the speed of fire is materially increased—the recoil and counter-recoil synchronizing with the mechanism of the gun.

Hydraulic brakes with spring return are highly efficient and reliable but add considerably to the weight of the equipment. Reaction brakes, based upon the principle of directing the powder gas to the rear by means of parabolic baffles before or after the projectile leaves the muzzle appear, at first sight, to be an elegant solution of the problem. As far back as the eighties I experimented a device of this nature, proposed by Hugoniot, whose work is so familiar to designers of recoil checks. His idea was to reduce the maximum velocity of free recoil, and consequently the energy of recoil, by a series of gas ports and baffles along the chase of the gun. Experiments on the Sebert velocimeter demonstrated the efficiency of this arrangement—and also the disastrous effect of the rearward blast on the gun's crew! Since then, innumerable inventors have devoted time and money in efforts to produce a satisfactory reaction brake. It is beyond doubt that eighty per cent, and even more, of the energy of recoil can be absorbed, but the destructive effect of the powder gas on the baffle or baffles is yet to be overcome, as well as the rearward blast of the diverted gases. The problem is especially difficult in the case of automatic arms, and it should be remembered that the destruction of the baffle would probably result in the destruction of the mounting, and even of the carrying airplane. In the *Memoirs* of the Ingenieurs Civils de France of July-August, 1936, M. Bory, a French engineer, has published a long and interesting paper wherein he claims to have produced, in collaboration with M. Galliot, a thoroughly satisfactory muzzle brake, but unfortunately he gives no description of his device.

FIELD carriages for machine guns of the higher calibers, which may mount the gun singly or in pairs, are quite similar to those of antiaircraft artillery. For service afloat, the mountings are similar to those of the standard naval 3-inch antiaircraft guns. These machine guns of higher caliber may be effectively used, not only for supplementing antiaircraft artillery at the shorter ranges, but to assure unaided the defense of positions of relatively minor importance. It is my own studied opinion that 25 mm. or 1 inch is the ideal caliber for the antiaircraft machine gun. In the 20-mm. caliber, the weight of the projectile and its explosive charge is distinctly insufficient, whilst the weight, power, and cost of the higher calibers is excessive in comparison with the results obtained. Roughly, these three elements vary proportionally to the cube of the caliber.

High-explosive shell for antiaircraft 25-mm. machine guns are fitted with supersensitive, self-destroying fuzes. As the destruction of the shell should take place at a range beyond 4000 yards, the bulk and weight of a time train become prohibitive. The Brandt 25-mm. fuze is, in this connection, of particular interest. The 25-mm. shell, with an initial velocity of 925 met. sec. (3000 ft. sec.), rotates about its longitudinal axis at the muzzle at the rate of about 80,000 turns per minute. This speed of rotation is reduced rapidly and progressively by the skin friction of the projectile during flight. In the Brandt fuze, a firing pin is locked by a series of balls forced outward by centrifugal force against the pressure of a spring. When the speed of rotation is reduced by a given amount, corresponding to the desired range, the spring overcomes the centrifugal force, the firing pin is released and the shell exploded. A mathematical expression of the law of retardation of rotation has yet to be developed, but is not beyond the limits of analysis.

The use of machine guns for defense against armored cars and tanks has led to the development of special carriages and equipment for this purpose. The caliber .50 machine gun, using armor-piercing bullets, is effective against lightly protected cars and against the side plating of tanks within the admitted combat range of from 600 to 700 yards. Against heavily armored tanks in frontal attack, much greater penetrative power is required. An antitank machine gun, in addition to such power, should be light and maneuverable, capable of accompanying the infantry, and able to take advantage of any available cover. One of the great military powers of the Continent has adopted the caliber of 25 mm. for this purpose. It was considered that the perforation of 2 inches of steel at 650 yards would be required, and that this could be secured more economically and efficiently with a high-velocity gun of small caliber than with a heavier gun of lower initial velocity employing heavier and far more expensive ammunition. This particular country adopted, however, a semiautomatic gun instead of a fully automatic weapon on account of slightly less weight and considerably less cost. These guns are drawn by light tractors of the Carden-Loyd type, which also transport the gun crews and ammunition supply.

The development of an efficient machine gun was long retarded by the lack of suitable and reliable ammunition. The Requa Battery, for instance, was designed to fire the service paper cartridges. These were seated in a perforated frame, and introduced into the barrels by a lever-operated platen which acted as the breechblock. The gun was primed with a fine-grain powder, a percussion cap was seated on a nipple, and the thirty-two barrels were discharged by a lanyard-operated hammer.

In the case of the Coffee-Mill Gun, paper cartridges were loaded into heavy iron cylinders primed with percussion caps. These were fed into the gun by gravity, and dropped to the ground when fired, no extractor being necessary.

The Gatling gun became successful only when the caliber .50-inch center-fire metallic cartridge, devised by my father, had been produced at the Frankford Arsenal.

When automatic machine guns were first proposed, it was required that they should fire service infantry ammunition. These cartridges, designed for the hand-worked rifle, often presented great difficulties. My own principle, relentlessly observed, was never to admit that malfunctioning of the gun could be laid to the ammunition, which was the usual excuse advanced by the shop. In the case of the French 8-mm. ammunition, the bottle-neck cartridge, designed for the under-barrel magazine of the Lebel rifle, presented great difficulties in feeding, and the loosely seated primers had a disconcerting way of dropping out under the action of the ejector. A dropped primer would jam the mechanism, and it generally was necessary to strip the gun for its removal. This difficulty was overcome by so forming the face of the breechblock that it crimped the primer firmly in place when the breech was closed. In later fabrication, the primers were, of course, firmly seated and crimped. The solid copper French bullet, of well-known accuracy, is the least destructive of the barrel of any

in service. Rimmed or flanged cartridges also presented great difficulties, especially in the case of box magazines.

In the 1890's, the 7-mm. Spanish Mauser cartridge was in very universal use and is still the service infantry ammunition in most of the countries south of the Rio Grande. Today, the German 7.92-mm. Mauser is perhaps the most widely distributed, marking the tendency toward a larger caliber. Automatic machine guns have been built for a great variety of ammunition, ranging from 6-mm. to the United States caliber .30-inch, the British .303-inch, and the French 8-mm.

Each type of cartridge presented a new problem, and one type would often show up a defect in the mechanism of the gun, which was not apparent with another. The solving of these problems gave to long-established constructors a wealth of experience which was and is of inestimable value. It is perhaps for this reason that the design and fabrication of machine guns has been left largely in the hands of private industry.

As has been observed, there has been a trend from the small caliber (under 7.5-mm.) ammunition, and a caliber of .35-inch is now contemplated as standard for infantry machine guns, whilst continuing the use of the infantry ammunition for the machine rifle. It is considered that the complication of a special machine-gun cartridge will be overbalanced by the advantages of a heavier and more powerful bullet for long-range barrage, antiaircraft fire, and for the attack of lightly protected cars. It should be remembered that machine-gun ammunition is issued on belts, loading strips, or in magazines, and being specially packed, confusion in the field is hardly to be anticipated.

THE problem of feeding cartridges to machine guns is of mechanical, tactical, and economic interest. In the hand-worked guns, gravity feed was employed and was fairly satisfactory, as high-angle fire had not become a necessity. Perhaps the best of the gravity feeds was the Bruce, developed at the Springfield Armory for the Gatling gun. With this feed, the cartridges were stripped, with a single movement, into guides from the twenty-round cardboard boxes as issued to the infantry. This device was followed by the Accles mechanical feed, a great advance over previous conceptions. It comprised a drum mounted with its axis parallel to the barrels, and containing 250 cartridges. These were engaged between fixed helical guides, with a rotating feed wheel geared with the rotating group of barrels. The action of this feed was positive and involved the principle of never leaving a cartridge out of mechanical control.

The so-called Lewis automatic machine gun has a drum feed which was derived from the Accles feed but with its axis at right angles to the barrel. It has the advantages of being seated and removed readily and quickly and of not materially interfering with aiming; being spring-actuated it is not entirely mechanical in its operation. It has the disadvantages of very considerable weight per cartridge and of high cost.

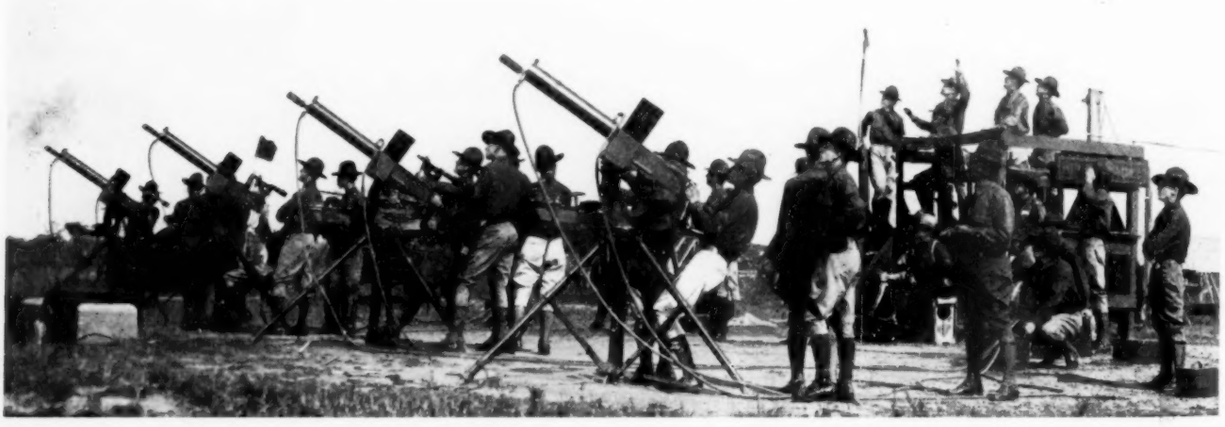
The belt feed, as originally devised by Maxim and still in very extensive use, has the advantages of moderate weight and cost and of positive action. It offers certain difficulties in high-angle fire, and time is required for removing a partially exhausted belt when changing position.

The box magazine, seated either vertically or horizontally, has the advantages of being seated and removed quickly and readily. The cartridges are forced into the receiver of the gun by a series of V springs, and the gun itself is simplified by the absence of feed mechanism. The disadvantages are the weight per cartridge, high cost of production, and especially the fact that the springs are compressed during long periods and are subjected to the shocks of transportation. A weakened spring may cause a jam at a critical moment. The rigid feed strip of from fifteen to thirty rounds has the advantages of positive action and low cost, but requires well-trained men for its effective use.

One essential, which at times has been overlooked in the design of feed mechanisms, is that on cessation of fire a live cartridge should never remain in the chamber of the gun. The tactical necessity for this is self-evident.

In what has preceded I have attempted to sketch briefly the development of the machine gun from the hand-worked, multiple-barrel, horse-drawn weapon, to the single-barrel, automatic, and highly mobile arm. When maneuvered as, and pitted against field artillery, the machine gun was a failure, but the modern arm, tactically employed as at present, is one of the most efficient and effective weapons at the disposal of combat troops.

After this hasty and superficial review of machine guns, I may add that there are no armament problems making greater calls upon the resources of applied science than the development of an efficient machine gun. In addition, the difficulties of mass fabrication, inspection and experimentation are great and costly. Long and varied experience is a necessity of the successful designer, and I have often recalled the words of the lamented Thomas A. Edison: "The most valuable part of my knowledge is my knowledge of the things that won't work."



Army and Navy Munitions Board

The Peace-Time Coördination of War Requirements

By Col. H. W. T. Eglin*

THE Army and Navy Munitions Board is the established agency for dealing with procurement problems requiring coördination of Army and Navy interests. It came into being in June 1922 following a recommendation of the Joint Board to the Secretaries of War and the Navy that there be created a board to be known as "The Army and Navy Munitions Board" to be composed of the Assistant Secretary of War and the Assistant Secretary of the Navy, with such assistants, committees, or subordinate agencies as in the opinion of the Board may be necessary and advisable. The Joint Board further recommended that the Army and Navy Munitions Board have the duty of coördinating the planning for acquiring munitions and supplies required for the Army and Navy for war purposes or to meet the needs of any joint plans, and of evolving a legislative plan which would allow the procument program to be put into effect. These recommendations were approved by both Secretaries, and the organization of the Army and Navy Munitions Board was created, November 29, 1922. This action of the Joint Board was initiated by a memorandum of the Assistant Secretary of War dated February 15, 1922.

INDUSTRIAL mobilization planning has certain definite bases of authority under the substantive law of the United States. The principal source of authority is the National Defense Act of 1920. From this mandate arises the Industrial Mobilization Plan, the latest revision of which was issued December 10, 1936, bearing the approval of the heads of the Army and Navy.

In order that readers may be familiar with the peace-time development of plans and policies of industrial mobilization we hope to publish a series of articles, of which this is the first, on the governmental agencies which are constantly at work on these matters. This article, as its title indicates, describes the duties, functions, and current status of the Army and Navy Munitions Board.—EDITOR.

But even before this, we find other studies pertaining to the coördination of joint requirements. In June 1919, the War Plans Division of the General Staff initiated a general study of the subject. In the meantime, the National Defense Act, which charged the Assistant Secretary of War with the statutory obligations pertaining to industrial mobilization, was passed in 1920.

The Army and Navy Munitions Board has passed through different phases of organization. As first organized, it consisted of various committees to assist the Board proper. Its present organization consists of the Assistant Secretary of War and the Assistant Secretary of the Navy, assisted by an executive committee composed of three officers of the Army and three officers of the Navy, selected by the Secretary of War and the Secretary of the Navy, respectively.

The principles which guide the Munitions Board in the various phases of its activity, as set forth in the Industrial Mobilization Plan, may be enumerated briefly:

"It is a continuing duty of the Army and Navy Munitions Board to further war-procurement planning in those phases wherein a joint Army and Navy interest arises. The procuring agencies of the War and Navy Departments are charged with full responsibility for the timely procurement of the supplies assigned to them for procurement. The Army and Navy Munitions Board, in coördinating plans, will continually recognize the responsibility of the procuring agencies and in formulating plans will leave to the established procuring agencies the greatest freedom of action and initiative consistent with the necessary interservice coördination in time of war.

"Shortages and delays in the procurement of supplies in time of war will be minimized by peace-time studies of Army and Navy requirements and the resources and facilities available to the nation in war and by the preparation of plans to adjust discrepancies between Army and Navy requirements and national resources. It is vital that integrated departmental material requirements be determined with rapidity in order that allocations and priorities may be determined to meet a rapidly changing military or naval situation.

"Procurement is subsidiary to military operations and is in support of military operations. It is essential for the successful launching of a war-procurement program that the War and Navy Departments keep available for procurement work at the outbreak of war, qualified personnel conversant with the problems involved for such a period as will enable their successors to qualify fully for the responsibilities they will be required to assume. The personnel required to cope with problems involved in procurement planning and war procurement must receive a high degree of training.

"In the coördination of procurement plans of the Army and the Navy, due consideration must be given to the essential needs of the civil population."

THE Army and Navy Munitions Board, moreover, is authorized and directed to: (a) Formulate and keep up to date such pertinent plans and policies as in the opinion of the two Departments should be adopted by the Federal Government for coördinating and controlling national industrial effort in an emergency; (b) Assure the necessary coördination in the procurement war plans of the Army and Navy, and in all plans, studies, and appendices thereto intended to facilitate the Government's efforts in an emergency to promote orderly mobilization of industry; (c) Form and direct the activities of such joint committees as may be necessary to consider, investigate, and make recommendations concerning pertinent subjects falling within the purview of the Board's responsibilities; (d) When a war emergency is

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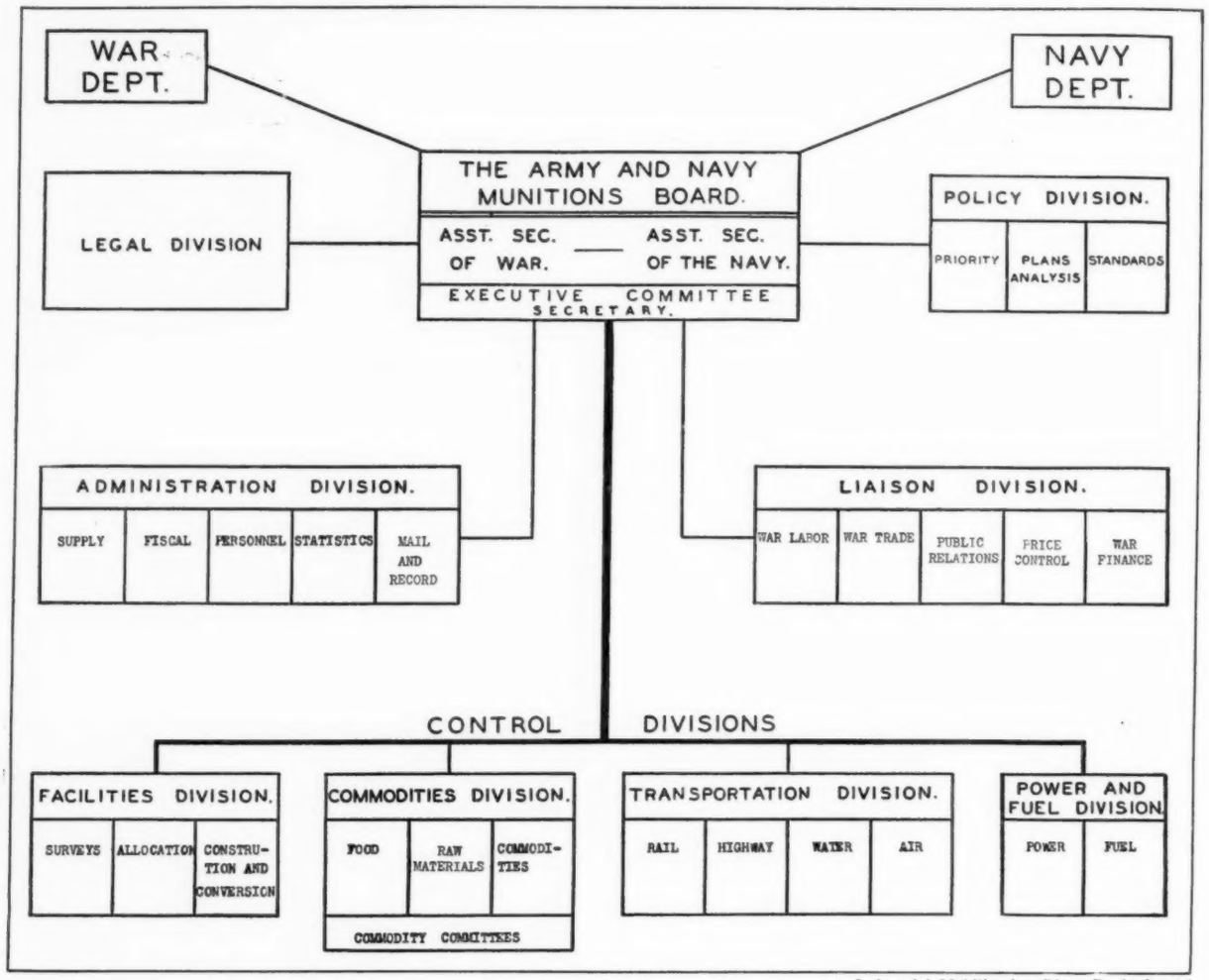

Industrial Mobilization Plan, Revised 1936

ORGANIZATION OF THE ARMY AND NAVY MUNITIONS BOARD

imminent and until the War Resources Administration is functioning, to guide the industrial activities and the utilization of materials incident to the procurement programs of the Army and Navy, and in general coördinate the procurement program so that the War Resources Administration can operate under circumstances favorable to future control. After full development of the War Resources Administration as a national industrial superagency, the Army and Navy Munitions Board will continue to function as a procurement coördinating agency for the Army and Navy.

"Approval of action taken by the Munitions Board," according to the Industrial Mobilization Plan, "is not required, except that any plans prepared by it that affect joint war plans and joint Army and Navy policy relative to the national defense are required to be referred to the Joint Board for consideration before submission to the Secretaries of War and Navy." Problems upon which the Board cannot reach agreement are forwarded to the Secretary of War and Secretary of the Navy for adjudication.

THE Executive Committee is charged with such responsibilities as the following:

Coördinating the work of the divisions of the Board; developing and recommending policies pertaining to procurement, in time of war, of supplies in which the Army and the Navy have joint interest; preparing and submitting on May 1st and November 1st of each year an annual progress report of joint procurement planning; causing a joint study to be made annually of the several parts of the National Industrial Mobilization Plan, and submitting as of May 1st, each year, a report on the status of the Industrial Mobilization Plan, together with any recommended changes.

The Committee is also charged with studying methods in use in the War and Navy Departments for determining data on which procurement plans are based and making recommendations leading to the simplification and coördination of methods in order to reduce the time required for the presentation of total material requirements under any specific plan of operations.

One officer from the Army and one officer from the Navy selected by the respective departments are assigned to duty in the Army and Navy Munitions Board, the senior officer being secretary of the Board.

When a problem arises in either service it is referred to the Army and Navy Munitions Board. The secretary forwards it to the senior member of the Executive Committee of the other service for comment and recommendation. The Executive Committee then considers the problem indorsed by the views of both services and makes its decision based on those views and the interests of both services, or, if necessary,

it may be referred to the proper division of the Board for study and recommendation before final action is passed by the Executive Committee. Action having been taken by the Executive Committee and approved by the two Assistant Secretaries, it becomes an approved joint procurement plan, policy, or allocation, as the case may be, and stands as a policy for future problems of a similar nature.

I SHOULD like to quote again from the Industrial Mobilization Plan:

"The Army and Navy Munitions Board, although not exercising any control over civilian industry, coördinates the industrial demands of the Army and the Navy and, until the War Resources Administration is created and ready to function, clears procurement requirements for the fighting forces, allocates facilities, assigns production and delivery to meet prescribed military priorities, and in general coördinates the procurement program so that the War Resources Administration can take over its functions under *circumstances favorable to future control.*"

Just what will be those circumstances favorable to future control by the War Resources Administration? They will be a reasonably accurate knowledge of requirements, facilities, materials, power, labor, and transportation not only for the Army and the Navy, but also for civilian needs, balanced against existing sources of supply, together with plans of procedure, in order that the War Resources Administration can start its operations with a tangible foothold.

The Army and Navy Munitions Board is designed to be available as a nucleus for the War Resources Administration, pending its full organization. It has thus been organized into divisions appropriate to a rapid transition to full development under that agency. These divisions are composed of officers engaged in similar duties within their respective departments. Representation from the Army and the Navy is provided on each committee or division. The general functions of these divisions are to prepare in time of peace plans for procurement and industrial mobilization and to coördinate these plans during war until superagency control is established.

This provides for the orderly operation of those control measures which will be necessary during the transition period which follows strained relations and imminence of war, and lasts until the necessary superagency control is in operation.

We all remember the functions of an advance guard in a meeting engagement—to take over, develop, and hold the situation in hand in the early phase of the crisis until the main body can take it over. It is then absorbed into the main body and becomes a part of it. Just so will the personnel of the Army and Navy Munitions Board, augmented by other officers from the Army and the Navy, step in on M-Day following the President's proclamation, and take charge in the early moments of the emergency, assist in the development of the War Resources Administration which will hold the situation intact until the other superagencies are in position to carry on in case their creation becomes necessary.

Since the War Resources Administration, during this transition phase, will probably be the only superagency organized, it should make the effort to cover all problems which normally would be handled under full superagency operation. In other words, during the transition phase, the War Resources Administration would be used, as far as possible, as a complete superagency, and later on, as the full superagency organization under the Industrial Mobilization Plan was developed, those functions which properly belong in the other administrations as provided for in the Industrial Mobilization Plan would be taken away from the War Resources Administration.

THE divisions of the Army and Navy Munitions Board, whose definite responsibilities just have been outlined, are composed of a Navy representative and an Army representative. The Army representative is the chief of the corresponding division in the Planning Branch, Office of the Assistant Secretary of War. The vital question is—what data and plans could be turned over to this superagency, if called for, if M-Day is next week or next month? Would we have an actual plan? *Would the plan work?* How much would it help the superagency? I think it would be advisable for us to think this over, because after all that will be the final test and the measure of value of all these years of planning since the passage of the National Defense Act.

What plans then are available now? First, there is the Industrial Mobilization Plan (This is a public document copies of which may be obtained from the Government Printing Office, Washington, D. C., at 15 cents a copy.); secondly, the Unit Plan of the Army and Navy Munitions Board which describes the steps to be taken on M-Day to bridge the transition phase and to form the working machinery of the superagency; and thirdly, the Operations Plan of the War Resources Administration which has been completed with the following annexes: facilities, commodities, power, transportation, labor.

The War Trade annex is being prepared, which leaves yet to be completed annexes on Price Control, War Finance, and Public Relations.

I think you will agree that if the Industrial Mobilization Plan and its Operation Plan are *complete in detail* and *sound in principle,* they will greatly assist the Administrator of War Resources in taking over his functions under circumstances favorable to future control. Moreover, the peace-time mission of the Army and Navy Munitions Board will have been accomplished.

The results accomplished by the Army and Navy Munitions Board in the past two years may be placed in the following classes: joint plans; allocation of facilities and capacity credits to the Army and Navy; miscellaneous problems affecting procurement and requiring joint agreement. Under joint plans, the revision of the Industrial Mobilization Plan is the outstanding achievement of the year. It has been approved by the then Acting Secretary of War and the Secretary of the Navy. Under the allocation program, production capacities for many items have been allocated, which include gages and machine tools.

The Board has on its schedule of proposed subjects for future consideration and study such subjects as the following: The continued development of joint requirements and joint procurement plans for items of equipment and supply, and for the strategic and critical materials entering into the construction of these items; an analysis and evaluation of the progress in the various elements of procurement planning and the expedition of the allocation of facilities to the Army and Navy; the joint study of the Industrial Mobilization Plan.

In conclusion let me state that every effort is being made by the Board to establish policies, foresee difficulties in war-time procurement, and perfect during peace time, plans for solving or minimizing such difficulties as may arise in an emergency.

Mechanical Time Fuzes

Some Design and Production Problems of Their Development

By Lieut. Col. John G. Booton*

WE MODERNS are inclined to think of the need for an accurate mechanical time fuze as of recent origin. We know of the slower burning of the powder-train fuze at decreased pressure when it is fired to high altitudes. We have heard of the difficulties in manufacture of a fuze powder that will burn at a uniform rate even when the pressure is uniform. And we know something of the search for a composition that will burn slowly enough to give a time much over twenty seconds in the length of train that can be built into a disc-type fuze. We have perhaps heard of the difficulty of venting a disc fuze to be fired with high rotational speed so that the centrifugal force acting upon the gases from the powder train will not cause erratic burning of the time train. But we are inclined to assume that these problems have arrived along with our high-velocity long-range guns, and that they did not exist with the shorter ranges and lower elevations of the guns of an earlier day. As a matter of fact, the search for a good mechanical time fuze began shortly after the general acceptance of rifled cannon with elongated projectiles as superior to smooth-bore guns using round shot. The first mechanical fuze, an inclined tube containing shot which were to run out of a variable orifice under the influence of centrifugal force, was proposed and experimented with about 1860.

General von Willie, writing on "The Cannon of the Future" some fifty years ago, is quoted as saying: "Disc fuzes have outlived their time and ought soon to be replaced by fuzes of another type. The complaints regarding the changes which take place in them after they have been stored are as old as the fuzes themselves. In spite of the supposed impermeability of its casing, the time train absorbs moisture, which, although directly extending the time of combustion, favors its electrochemical decomposition, thus contributing indirectly toward the irregularity of that very time of combustion. The latter is also affected by variations in the atmospheric pressure".

With this as a beginning, what a masterpiece might the General have achieved had he been able to look into the future to see our present long-range high-trajectory guns and to see some of the targets moved up into the air to 20,000 feet altitude and flying at a speed of 300 feet per second! However, much work was done on the mechanical fuze long before the flying machine was an accomplished fact, but the requirements for the attack of aërial targets seem to have pushed mechanical fuze development into a working design, possible to manufacture under mass-production methods.

BEFORE discussing the various mechanisms and principles that have been tried, it may be well to outline the various things that happen to a fuze when it is fired. In a high-velocity gun, the fuze must be accelerated to a velocity of some 2600 to 2800 feet per second in the length of the bore and in a time measured in thousandths of a second. In this same time, the parts are subjected to the twisting forces required to produce a speed of rotation at the muzzle of 16,000 r.p.m. for a 3-inch gun rifled to give one turn in forty calibers travel. If the gun is rifled to give one turn in twenty-five calibers, the shell will reach a rotational speed of 26,000 r.p.m. The fuze must arrive at the muzzle with none of the running or timing parts deformed or displaced. As the shell leaves the muzzle, the fuze parts are subjected to the forces of elastic recovery from the propelling and twisting forces applied to the base of the shell while it is in the gun and to the sudden reversal of these forces when this recovery has reached its limit. The recovery forces are applied to the fuze parts in the same direction as those in the bore, but at the end of the recovery the direction is reversed, tending to throw the fuze parts in the opposite direction from that in which they were being pushed and twisted while acquiring their velocity.

At about the same time, the shell has reached the still air outside the cone of the blast, and the forces required to push and twist the shell through the air are added to forces on the fuze caused by the recovery of the shell. In addition to all these, the shell has generally received a blow on its base, either from the whip of the barrel or from the escaping gases, that throws its axis off the line of flight. In recovering from this, the nose of the shell gyrates in a series of loops about the line of flight. The fuze parts are thus subjected to forces throwing them from side to side until this motion is damped out. If the fuze has survived all this, it has a fairly easy time on out to the point of burst, spinning along with gradually reducing speed of rotation and translation and with gradual change of its axis of rotation to approximate the trajectory. Builders of such devices, however, continue to be depressed by the failure of even an occasional fuze and to hope that the improvement on which they are now working will produce, at last, the fuze that will be perfect in uniformity and functioning.

AS MENTIONED before, the first mechanical fuze that was considered seriously was virtually an hourglass, operated by centrifugal force and using shot as the timing medium. When the shot had all run out, they released the firing pin, which fired the primer. Despite the simplicity and seeming merit of the idea, the fuze could not be made to operate. Even when turned in a lathe the shot would jam in the orifice and it would either fail, or not operate at the expected time. Another early effort was to use the air pressure on the nose of the projectile as a means of timing. This pressure varies with the speed of translation. By balancing a piston acted upon by this pressure against a spring or a centrifugal weight, it seemed possible to make the fuze function at a predetermined point on its trajectory. But it could not be made to work. The friction on such a delicate structure is difficult to control within the limits required for the accurate functioning of the fuze.

Next in order was a fuze having wings projecting from

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the front, which were to be turned by the air and were in turn intended to operate a threaded spindle inside the fuze. A nut was to be moved down by the rotation until it came to the end of the threaded portion, when it would drop off and fire the primer. A second type by the same inventor had an eccentric weight, mounted on a central spindle inside the fuze body. This weight was supposed to take up little, if any, of the rotation of the projectile, and upon leaving the gun was supposed to take up a position below the axis of the projectile where it would act as a revolution counter and at the end of the desired number of revolutions of the shell, would run the nut off the threaded portion of the spindle and fire the primer, as in the one with the wings. Analysis of the structure will show that the force tending to hold the weight against rotation is very small as compared with the forces tending to rotate it, particularly while it is in the bore. The difficulty of controlling this friction within the limits required to produce accurate functioning prevents the structure from being of value for the intended purpose. Despite this rather apparent difficulty, the principle of the off-center weight was tried in many later designs, with reduction gearing for time control replacing the threaded spindle and nut of the earlier type. One of these modifications introduced the winding of a fine wire or thread from one bobbin to another to give the timing.

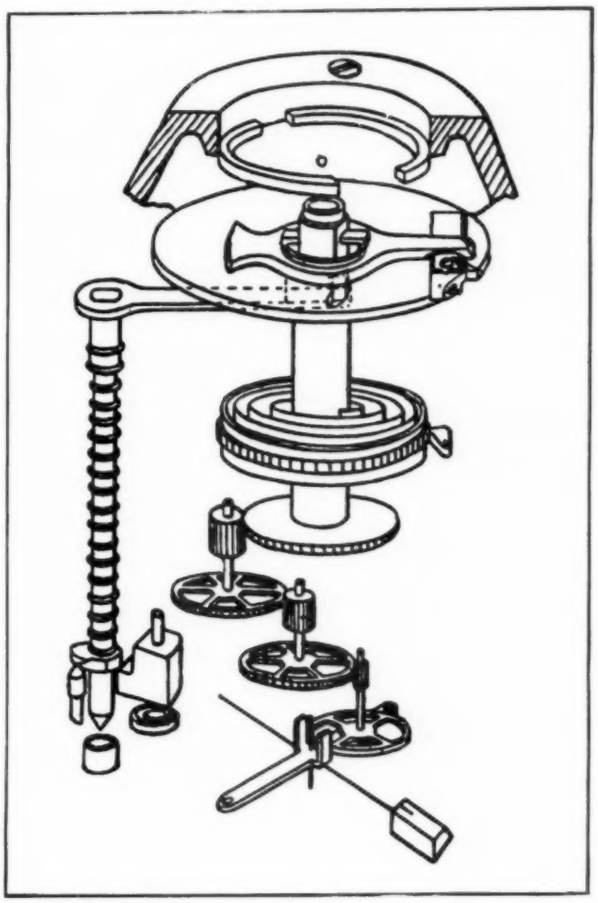


FIG. 1. KRUPP-TYPE, SPRING-DRIVEN FUZE

In 1889 there appeared an example of the liquid fuze, really a variation of the one first described, except that the timing medium was a liquid instead of shot. The difficulty with this was the control of the very small amount of liquid that could be used as to volume, size of the orifice, and change in viscosity for change in temperature.

NEXT in order appeared a number of types of combination time-and-percussion fuzes. The mechanisms of some of these display a high order of ingenuity in the design of the reduction gearing and other operating parts. One of these contains an interesting example of a firing pin operated by centrifugal force. The mechanism and operation of these early types are very ably reviewed in *Rivista d'Artigliera e Genio*, February 1928, beginning at page 193. This was translated and appears in *Memorial de l'Artillerie française*, Vol. VIII, No. 4, 1929, beginning at page 977. More complete description and illustration of these early designs is contained in *Revue l'Artillerie*, September 1895, page 559; September 1913, page 412; October 1913, page 14; and November 1913, page 101.

The three modern types of mechanical fuze known to be successfully manufactured and used are the Krupp fuze, the Junghans fuze, and the Tavennes fuze. The Krupp fuze, shown schematically in Fig. 1, comprises in general a central shaft driven by a clock spring whose speed of rotation is controlled by gearing ending in a centrally placed escapement with a straight hairspring. The light weight of the vibrating part and the strength of the hairspring make the escapement virtually a species of mechanically sustained tuning fork. By skillful design of the parts of the balance and of the wheel which drives it, it can be made independent of the driving power, so that it will operate at the same rate whether the power is just enough to run it or the maximum to which it will be subjected. This is the great advantage of the escapement or clock-work type of fuze. If the escapement can be made to run at the same rate, whatever the power that may be applied, it is independent of friction that may exist in other parts of the fuze and will give uniform timing from round to round.

At the top of the spring-driven shaft in this fuze is a hand, keyed to the shaft, but permitted to move upward under the urge of a small spring in the top of the shaft. Until the round is fired, the hand is held in place by the small end with a catch. When the round is fired, the catch is displaced and the hand is free to rotate and to rise and the fuze to run. The hand, however, can rise only as far as the ring upon which it bears in the fuze cap until it reaches the proper openings in this ring. The setting of the fuze is accomplished by moving the cap so that the openings in the ring are at the angular distance through which the hand is to turn before firing the fuze. When the hand rises into these openings, it releases the upturned end of the firing lever from the groove in the lower surface of the hand, in which it runs; the firing lever swings outward under the influence of centrifugal force and turns the firing pin so as to unlock it from the surface on which it has been resting; it then slides out of the sleeve on the firing lever and fires the primer. As the fuze is shown, the centrifugal lock at the inner side of the firing pin is in place. After the fuze has left the gun, this swings away from the firing pin so that the firing pin is free to fall when turned by the sleeve of the firing lever.

It will be noted that one end of the hand is wide and one is narrow, and that the openings into which it can rise are

similarly wide and narrow. Thus there is only one point in its revolution where it can rise. An adjusting block is shown at one end of the straight hairspring. This can be moved in or out in the course of assembly and adjustment to time the escapement to the rate desired.

The entire movement is housed in a series of plates, securely pinned and screwed together. In these plates are cut the spaces for the gearing and the required bearings. When the plates are assembled, they form virtually a solid metal structure within which the fuze parts operate. The top plate, immediately beneath the hand, is shown in the illustration. The movement is in turn screwed to the base of the fuze, which extends up along the side of the movement. Fitted over this is the lower cap, carrying the timing ring. The opening in the lower cap is closed by an upper cap, the three parts of the housing completely inclosing and protecting the movement.

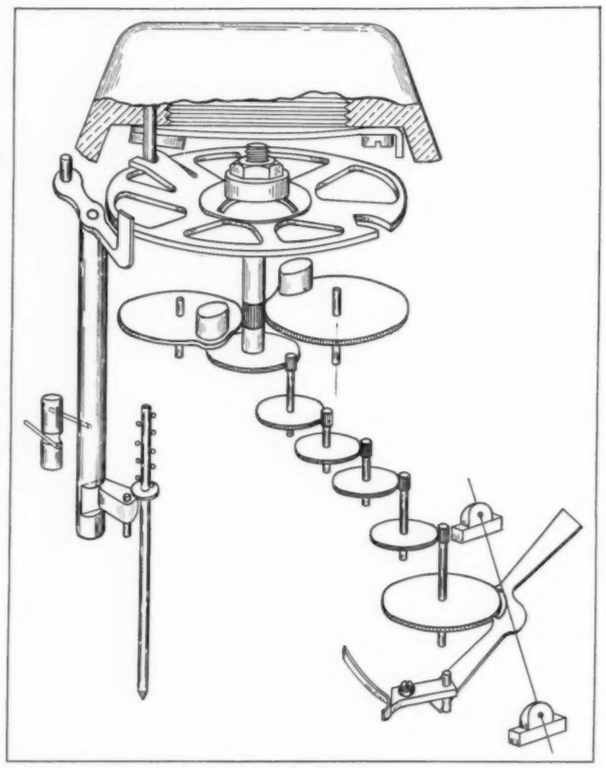


Fig. 2. Junghans-type, Weight-driven Fuze

Our service became interested in the Krupp fuze and bought some of them for test in 1914. The results were promising, but no more could be obtained from abroad because of the war, so attempts were made to secure domestic production of a satisfactory mechanical fuze. A number of possible makers were interested, but none of them was ever able to solve the many intricate problems incident to a successful design.

At about this same time, the Junghans fuze was being developed abroad. It is distinguished from the Krupp fuze chiefly by the motive power—two centrifugal weights mounted on gears meshing with the main shaft—and by the timing disc which is set to control the time till the fuze fires. Fig. 2 is a schematic drawing of the essential parts of the movement of this type of fuze. Under the influence of centrifugal force, the two weights shown on the two gears meshing with the central shaft give it power, as does the clock spring in the Krupp-type fuze. The central shaft, operating through a series of gears ending in the centrally placed escapement, is controlled in its movement by this escapement which is of similar type to that used in the Krupp fuze. Mounted at the top of the main shaft is the timing disc. It can be turned about the main shaft by the setting pin shown extending downward into the setting lug of the timing disc. This pin extends downward from the lower cap of the fuze housing, which, in setting the fuze, is turned to set the slot into which the firing arm falls at the proper angular distance from the firing arm.

When the round is fired, the hammer mounted in the lower cap comes down on the setting lug of the timing disc and flattens it against the top plate, which is immediately below the timing disc. This disconnects the timing disc from the setting pin and permits it to turn with the main shaft through the friction clutch by which it is attached. The setback safety holding the firing lever away from the timing disc has been displaced downward, and the centrifugal safety holding one end of the escapement swings out of the way under the influence of centrifugal force. The fuze is now ready to run, and centrifugal force acting on the weights to urge them away from the center of the movement puts the parts in motion. At the end of the set time, the firing lever drops into its recess in the timing disc, which allows the piece controlled by the lower end of the firing-lever shaft to swing out and the firing pin to fall. The two adjusting blocks used to adjust the period of the escapement are shown in place at the ends of the straight hairspring. Like the Krupp fuze, this movement is housed in a series of plates and the movement is in turn housed in a fuze base, lower cap, and upper cap which inclose and protect it.

When it became apparent that our efforts to encourage the domestic design and production of a mechanical time fuze gave little promise of eventual success, we once more turned our attention to foreign development. The Junghans fuze seemed to meet our requirements, and after some preliminary tests we purchased the rights to manufacture it in this country. We secured, in addition, the production equipment required to start manufacture, and sufficient engineering and production personnel to adapt the design to our use and to start its production. After a considerable period of experimental work, there resulted the M2 fuze, which is described in detail in the *Coast Artillery Journal,* July-August 1933. In this model, a device to secure detonator safety had part of its mechanism built in with other parts of the movement. A schematic representation of this feature is shown in Fig. 3. The weight-driven segment is driven outward against the resistance of the escapement, the vibrating part of which is mounted so that it operates by centrifugal force, hence it needs no spring. When the weight-driven segment has run out, the pin controlling the swinging block containing the detonator rises, and the detonator can swing into line with the primer so as to complete the explosive train. This device gives a delay of several hundred feet from the muzzle before it is armed assuring the safety of the gun and its crew if some other part of the fuze should fail.

Following the development of a booster to be common to all types of fuzes, this feature was eliminated, and the fuze

parts redesigned into the present M43 fuze. In the course of this redesign, some of the parts were considerably strengthened to meet the higher stresses in the 1-in-25 twist antiaircraft gun in which the M2 fuze had generally given a considerable proportion of failures. To reduce the weight of the whole assembly, the movement is now mounted in an aluminum base with a brass lower cap and aluminum upper cap.

The other modern fuze, the Tavennes, is distinguished by a hairspring which is wound in a close spiral about the escapement staff, by a central firing pin which eliminates the friction caused by centrifugal force on the out-of-center firing pins of the Krupp and Junghans fuzes, and by a means of setting which requires several revolutions of the cap to set the maximum time and which simultaneously winds the mainspring. This latter feature offers two advantages. One is that the mainspring is stored only partially wound. The other is that the angular distance through which the cap is turned for a given unit of time is greatly increased, giving greater possible accuracy in setting. This system has a disadvantage in that the fuze cannot be set through zero, but can be set only from the lowest to the maximum time. Its chief distinguishing feature is, however, the escapement with its spiral hairspring with large angular sweep and slow period as compared with the Krupp and Junghans type with straight hairspring, light pallet, and short angular sweep giving a very short period. The proponents of the Tavennes and the Krupp systems have argued the virtues of the respective devices at considerable length in various documents which have been prepared for the information of possible purchasers. About the only conclusion that can be drawn is that both systems work with a fairly high degree of precision as compared with the powder-train fuze. We have been well satisfied with the accuracy of the Junghans-type fuze and have found no reason to believe that either of the others has shown any better performance in uniformity, safety, or certainty of action.

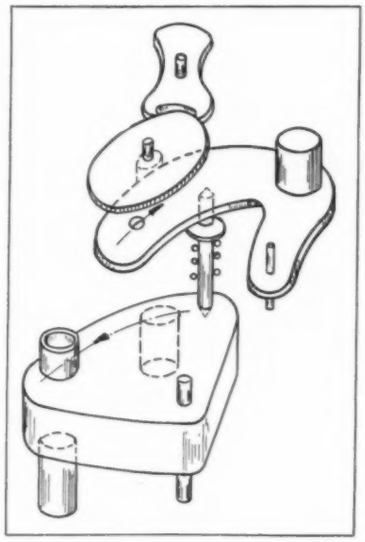


FIG. 3. DETONATOR SAFETY DEVICE OF JUNGHANS-TYPE FUZE

THE M43 fuze is built and timed for the 1-in-40 twist 3-inch antiaircraft gun. That is, the rate of running is adjusted so that when rotated at 16,000 r.p.m. for thirty seconds, the timing disc will run through the angular distance equal to thirty seconds of the time scale engraved on the fuze cap. If run at slower speed, the rate of the escapement is slower. When the movement is given no rotation and is run with a pulley and weight, it will run approximately one second slower in thirty seconds than it does when rotated at 16,000 r.p.m. When run faster, as in the 1-in-25 twist gun, the movement runs correspondingly faster. So far as can be determined, the speed of the escapement is not affected by variations of the power applied to it. That is, when the movement is run statically, it will run at the same rate from an amount of power just required to operate it, to an amount many times greater. Similarly, a change in the driving weights does not affect its speed and timing when run on the rotating machine. Either the designers had a great deal more engineering knowledge than we have ever been able to find in any of the texts on the subject of escapements, or they did a lot of patient cutting and trying. However they got it, the escapement as turned over to us is not varied in rate by the power applied to it. But it does vary slightly with the speed at which it is rotated. The most probable reason for this seems to be that the centrifugal force applied to the two ends of the straight hairspring tends to increase its effective strength in the same way as if the two ends were to be grasped and pulled outwardly. Some effort has been given to changing the structure of the escapement so that as the power was increased the rate would become slower. This could then be used to balance out the increase of rate caused by the effect of centrifugal force on the hairspring. Unfortunately all of the variety of changes that have been thought of and tried have had the opposite effect.

The results of this are that in the 1-in-40 twist gun the fuze runs slightly slower as the time of running is increased, indicating a considerable loss of spin. In the 1-in-25 twist gun the rate is at first much faster than the set time, but as the time becomes longer the amount of gain becomes less and less, indicating that at around thirty seconds time of flight the spin of the projectile is approaching the 16,000 r.p.m. for which the fuze was timed. The only difficulty with this is that the time scale on the fuze cap does not give exactly the true mean time of burning. It could of course be adjusted for a given combination of gun and shell so that it would give the true mean time of burning by engraving the time scale to the actual results secured in firing. It would, however, not be a true time scale for a gun giving a different initial spin or for a shell with a different rate of change of spin. The matter is of little importance, as firing tables are constructed to give the correct setting for the fuze, using the time scale as an arbitrary index, and fuze cams are cut to give the fuze this setting. One of the arguments for the Tavennes fuze is that its spiral hairspring, which is closely wrapped about the shaft of the pallet, is not subject to this effect of centrifugal force on a straight hairspring, so it gives the same mean time with widely varying spin. Our fuze is actually timed on a rotating machine approximating the spin of the shell in the 1-in-40 twist gun. Fuzes for the 1-in-25 twist gun are timed at this same speed. Because of variations in manufacture, the gain in rate for the higher speed is not exactly uniform, so that when the fuzes are fired in the 1-in-25 twist gun, the mean variation is generally somewhat larger than in the 1-in-40 twist gun.

THE great problem in the manufacture of such an item as our present fuze is the "know how" required for the production, fitting, and testing of the parts and the mechanical equipment required for these purposes. As originally developed, we had no tolerances for the various parts, so they were made as nearly as possible to the drawings with hand fitting until the parts would operate. By a process of measuring finished fuzes selected at random, permissible toler-

ances have been worked out, generally considerably less than the tolerances found in the fuzes selected for measurement. Following this has been the attempt to find suitable equipment for production of the parts required. Unfortunately the best equipment for many of the operations is not produced in this country. It exists in watch and instrument shops making similar products but was either purchased from abroad by them or copied by them from purchased equipment. Some domestic equipment, such as Brown and Sharpe automatic lathes for turning pivots, was adapted successfully and was found to produce to the required tolerances. Some other machinery has been purchased from importers, and our fuze shop gradually is being converted to the production of parts requiring less hand fitting.

Our next problem is that of obtaining increased production, if it should be required by military emergency, from commercial sources. While it has not as yet been tried, it is believed that with the experience we now have, it will not be difficult to start production in the plants of watch or instrument companies having suitable equipment. There are many of these. It is hoped that one of them may be given a suitable order to test the belief that the starting of production in such a plant is not difficult.

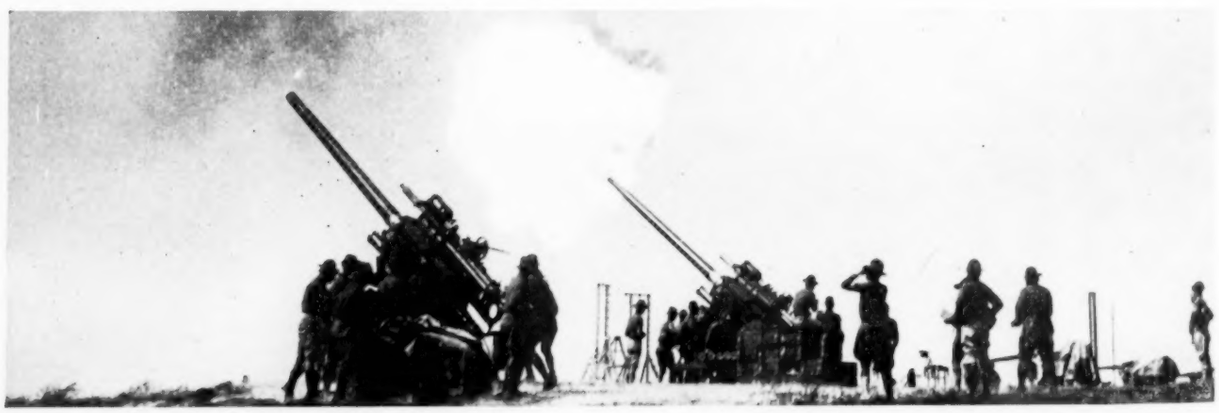
There is always in the back of the mind of anyone who has given serious thought to the mechanical fuze, an idea that there must be some way to design a mechanism with fewer parts more readily produced than those so far found successful—something, let us say, based upon a ball and ball race, both of which are produced in quantity to almost unbelievable accuracy. The forces which are interesting as a means of operation are the decrease in resistance as the shell loses velocity and the corresponding loss in spin. Decrease in resistance can be accurately calculated. Decrease in spin has never been accurately established. Study of the records of results with the mechanical fuze indicates that a 3-inch shell may lose as much as a third of its spin in thirty seconds. This can be questioned, however, by wondering how it manages to remain stable for a much longer time on the descending branch of its trajectory where the velocity is again increasing.

IN CONSIDERING the general problem of mechanical-fuze design, one of the primary considerations is that the parts must not deteriorate by corrosion or by aging, otherwise the mechanical fuze would have no advantage over the powder-train fuze for long storage. This requires a careful selection of materials for such important and delicate parts as the hair-spring. The springs to be stored under tension should be reduced to the minimum number. In our fuze, the firing-pin spring is the only one likely to be affected. In the latest design of fuze produced by the Junghans Company, the firing pin is operated by centrifugal force. We have not as yet thought it necessary to follow this design. M2 fuzes which have been in storage a number of years are tested periodically. Their functioning is still satisfactory despite the length of time they have been under storage conditions.

The liquid type of fuze seems to be one of the most tempting to inventors because of its simplicity. It will be noted, however, that it must almost certainly be stored empty and filled shortly before use, and that it has a further disadvantage in that the escape of liquid depends upon viscosity, which in turn depends upon temperature. Our mechanical fuze has not shown any variation because of difference in temperature in the shop tests that have been conducted, nor has there been any indication that temperature affects the fuze when fired.

A POINT to be remembered in considering any design is the very rapid increase in centrifugal force as a part is moved away from the center of the movement. Thus a gear placed too far from the center may have so much friction at its pivots as to prevent the running of the movement. With an r.p.m. of 16,000, a mass of one gram placed thirty millimeters from the axis would be subjected to a centrifugal force of about nine kilograms. In general, it can be said that a mechanical fuze should be designed by personnel familiar with the forces which may affect the structure. The movement of our M2 fuze would stand rotation with an air motor at speeds of around 40,000 r.p.m. but would fail frequently when fired in a gun giving 26,000 r.p.m. at the muzzle, apparently because of the rapid change in the velocity and in the speed of rotation.

In conclusion, it can be said that we now have a satisfactory type of fuze which performs as well as any of the types known to be under actual manufacture and in use. We have had enough experience in the development of the M2 fuze and in the modifications that have been made since to remove most of the mystery from it and to make us feel that we can modify it to meet any condition that can be met by this type of movement. We are gradually improving the methods of production and feel that the eventual cost, when produced in quantity, will compare favorably with that of the powder-train fuze. However, if anyone should think of a system having two or three moving parts that could be made to the required accuracy on automatic machines we would be much interested despite our satisfaction with the clock-work type.



ARMY ORDNANCE

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Month by Month

THERE can be no question about the value of peace-time civilian leadership in the cause of our national defense. We have always had among the patriotic populace of our country innumerable men whose loyalty to the country's security has expressed itself in clear and unmistakable terms. These individuals who are not members of the professional military and naval service combine with their daily vocation a hearty interest in military affairs the better to equip themselves to be of public service should the emergency of war come. Whether as commissioned officers or simply as men in the ranks, they have sworn themselves to the defense of the country subject to the call of national or state authority. These men, who are the very backbone of our American tradition, are civilians who serve in the National Guard or in the Reserve forces of the Army and Navy. They are soldiers or sailors not so much in actuality as in possibility. Their military duties are approached with a seriousness and concern which are the measure of our real military and naval strength. Civilians they are in peace, qualified military and naval personnel in war only. They are part and parcel of the national defense of the United States at all times.

A NEW ASSISTANT DISTRICT CHIEF

But there is another band of civilian leaders less subject to public notice but equally essential—more essential probably than a military title can indicate. Among this band we include first and foremost those civilians who have undertaken the peace-time obligations of ordnance preparedness as officials of the fourteen Ordnance procurement districts. Without compensation or reward, they have undertaken the duty to give the best of their talents to the industrial problems of the Ordnance cause. They are the chiefs or assistant chiefs of districts and members of the districts' advisory boards. Service in these highly important offices is public responsibility of the first magnitude. When the number of this small band is augmented by new blood the occasion is as significant as when the ranks are depleted by the ravages of time. To welcome a newcomer of eminent qualification is a pleasant responsibility, because it signifies, above all else, continuity of a time-tried system of industrial preparedness.

The newest member of this Ordnance civilian component is Mr. William Dunlop Disston whose appointment as assistant chief of the Philadelphia Ordnance District was announced recently. Mr. Disston becomes the deputy of Mr. Philip H. Gadsden, chief of the Philadelphia District and assumes the office made vacant by the death of Mr. J. W. Rawle several years ago. A lifelong resident of Philadelphia, the new assistant chief is the scion of a family long synonymous with industrial progress. Since his graduation from college he has been associated with the well-known firm of Henry Disston & Sons, Inc., rising from the ranks of an apprentice to his present position of vice-president, general manager and chairman of the company's executive committee. A mechanical engineer and a member of industrial and financial institutions of his native city, he is also identified with several hereditary patriotic organizations whose membership is confined to the descendants of those who served in our colonial and Revolutionary wars. Speaking, as we think we may, for his associates of the nation-wide Ordnance group, we congratulate the district organization upon the membership in its councils of one so well equipped to serve.

The new assistant chief now undertakes service in an unheralded and unsung band whose work for the national defense is least glamorous, yet most essential, to the public welfare. Seldom do its members attain public recognition beyond the esteem of the few who know the value of their enterprise. Occasionally one steps forth for well-merited recognition. Within the month the distinguished chief of the Detroit Ordnance District, Mr. Alex Dow, received well-merited honor at the hands of the American Institute of Electrical Engineers when he was awarded the society's Edison medal. From time to time similar honors come to others of the district personnel but by and large their Ordnance service is too remote for popular understanding in times of peace so that their quiet, effective work goes on apace with small popular recognition. Because this is so, Ordnance service is all the more appealing. Should it ever be translated from mere planning to execution, the popular mind will awake to realize, perhaps for the first time, that in the days of peace there were intensely patriotic men whose vision was not dimmed as to the meaning of modern war.

THE figures announced in the President's message to Congress communicating the budget for the fiscal year 1938, show a sizable increase in the funds proposed to be allotted to the Ordnance Department of the Army. This is a commendable step which the Congress would do well to approve without hesitation. The immediate need for larger expenditures at this time is clearly evident in the vastness of the problems which are associated with the changes brought about by military mechanization and motorization on land and in the air. Our esteemed contemporary, the *Army and Navy Journal,* in its issue of January 23, 1937, described some of these Ordnance responsibilities in the following words:

THE BUDGET

"Postwar problems of increasing fire power and the de-

velopment of mechanized weapons, without in any degree lessening the older problems of ballistics and propellants, have added enormously to the duties and responsibilities of the Ordnance Department of the Army. The semiautomatic shoulder rifle, the varied types of machine guns, the antitank gun, airplane bombs, and antiaircraft guns and other weapons upon which the Army will have to depend in any emergency, represent not only technical skill and patient research but also greater complexity for ordnance servicing in the field and more items and larger quantities for the supplying of ammunition. Correspondingly increased is the difficulty of keeping up adequate war reserves of ammunition and weapons. Weapons of war and ancillaries to weapons of war are charges of the Ordnance Department which bring under its province the developments relating to mechanization. The new light tanks and combat cars designed and manufactured by the Department have been received with general favor by the arms. The servicing of these high-speed weapons has in turn complicated the Department's activities. Highly maneuverable rolling machine shops have had to be developed. Then, too, there is the high cost of maintaining tanks and other combat vehicles, creating a steady drain on Ordnance funds. Maj. Gen. W. H. Tschappat, Chief of Ordnance, has warned that 'their intricate construction, and the nature of their use, accelerates wear and causes a much higher rate of expenditure for maintenance than has been the case with nonmechanized types of Ordnance.' Meanwhile, money continues to be a pressing problem. Appropriations for the replacement of ammunition lost through deterioration and for the augmentation of war stocks have not been satisfactory. Construction is needed at Raritan Arsenal, N. J., and at a number of other Ordnance posts. The demands upon personnel become more and more pressing. The activities of the GHQ Air Force alone have created a need unforeseen in the strength assignment of officers and enlisted men and have led General Tschappat to recommend a material increase in personnel. Like many other branches, too, the growing technical requirements call for ample grades and ratings. Congress would do well to fulfill these needs."

This sums up the situation adequately. There remains only Congressional sanction, and judged by the defense-mindedness of the present Congress it would seem that the pressing responsibilities of Ordnance will receive approval as befits their urgency.

The Munitions Board Report

THE report issued by the Department of State on behalf of the National Munitions Control Board on January 6, 1937, is a very enlightening document. It contains complete information on exports of "arms, ammunition, and implements of war" from the United States for the period from November 6, 1935, to November 30, 1936. As directed by the joint resolution of August 31, 1935, such a report is to be made to Congress annually. Under the resolution, export licenses are issued by the Board to all licensed producers of and dealers in the articles which, by Presidential proclamation, are declared to be "arms, ammunition, and implements of war." At this writing, the text of the report is not published, but sufficient of its details have been made known publicly to demonstrate a truth which was perfectly obvious from the beginning; namely, that the badinage of the last few years about huge annual exportation of arms from the United States is just so much badinage. The report shows that, for the period covered, all types of exports other than aircraft, aircraft engines and parts, totaled less than four million dollars in value! Having a very meager private arms industry in the United States, all the crack-pot ideas instigated by *Fortune* magazine three years ago and seized upon by some statesmen as a good topic for paid-admission speaking tours, are thus shown to be crack-pot ideas. For if the *Statistical Abstract of the United States* had been consulted when fevers were running high, practically the same "small fry" status could have been shown. The *Abstract* has shown all along the following gigantic (!) export operations in firearms and ammunition: The average total value for the years 1921-1925 was $5,050,000; for the years 1926-1930 it was $5,509,000; for 1930, $3,512,000; for 1931, $2,164,000; for 1932, $1,668,000; for 1933, $2,652,000. And, in each of these periods, by far the major part of the total was metallic cartridges. Specifically, exports of metallic cartridges for the above periods were: 1921-1925, $2,436,000; 1926-1930, $2,004,000; 1930, $1,309,000; 1931, $874,000; 1932, $651,000; 1933, $739,000. The first report of the Munitions Control Board merely confirms what has been known all along. The arms exports for the year November 1935 to November 1936 are roughly valued at less than $4,000,000.

We have no desire to minimize the broad vision and fair treatment which we understand has characterized the Munitions Control Board's administration of the law. Moreover, when the report itself is published listing all licenses and the characteristics of individual shipments, the functions of the Board will be found to have considerable factual value.

The curious thing about the report is that it shows military and nonmilitary aircraft and aircraft engines to be the largest items in our exports of "arms, ammunition, and implements of war." According to the published figures, there were exported from the United States during the above period nonmilitary aircraft valued at $7,690,307, military aircraft $7,609,312, aircraft engines $5,863,433. Lo and behold, arms and ammunition bring up the rear with exports valued at less than $4,000,000. And that old favorite of soap-box orators and political campaigners, E. I. du Pont de Nemours & Company, trails the list with exports throughout the year amounting to the stupendous, grandiloquent, imagination-staggering total of $2780! Where are all the demagogs of yesteryear who tried to smear that and other great manufacturing organizations for their commercial sales abroad? Where are the propagandists who when domestic sales of chemicals warranted the employment of several thousand additional employees told the newspapers that "poison gas" was the reason for the employment? Are there none so gracious, now the facts are disclosed, to admit they were not telling the truth? Let us thank the officials of the Munitions Control Board for verifying what has always been the fact; *viz.*, that our exports of arms and ammunition are relatively so trivial that, all together, they have little effect on the issues of war and peace—not a trifle compared with our exports of cotton and wheat and oil and all other commodities. The pity is that the Board's report thus far has caused no public discussion. The report was submitted to the United States Senate on January 6th. At this writing, nearly a month later, little reference has been made to it. Maybe it is because the principal facts deflate a monstrous hoax.

IN the last issue of this journal there was published an analysis of the Report of the British Royal Commission on the Private Manufacture of and Trading in Arms. The author of the analysis is Sir Charles Petrie, the distinguished foreign affairs editor of *The English Review*. Comment created by Sir Charles' article prompts us to recommend to all readers who are interested in this phase of the ordnance problem, a close study, not only of the report itself, but also of the Minutes of Evidence taken before the Commission and upon which the report was based. These documents are available for purchase at nominal sums from His Majesty's Stationery Office, London.

COLONEL HANKEY'S TESTIMONY

We recommend particularly to students of the question the testimony of Col. Sir M. P. A. Hankey, who for nearly twenty years has served as secretary to the Cabinet and who, since 1901, has been in one high office or another connected with the Committee of Imperial Defense. Colonel Hankey's testimony is published in the Commission's Minutes of Evidence for the 20th and 22nd days. It is beyond doubt the most comprehensive and factual presentation ever prepared on the arms question.

Looking back over all the agitation of the past few years it is rather amusing to note the complete abandon with which this entire subject has been propagandized. Several years ago we had occasion in these pages to call attention to the first effort in this regard which took place at the Versailles Peace Conference. At this time the basis of subsequent attack was undertaken and, being a very nebulous sort of thing, it is indeed strange to what lengths the militant pacifists have gone in developing it. Among other detailed studies contained in Colonel Hankey's evidence is a step-by-step narrative of developments following a resolution of the first assembly of the League of Nations, December 14, 1920. Under this resolution a temporary Mixed Commission on Armaments was appointed by the Council of the League "to explore those aspects of the problem of disarmament which were not purely of a technical military character, but might properly be described as involving political and economic issues as well". Despite the fact that no evidence was taken by a subcommittee of the Commission, those who have led the attack against the private manufacture of arms in the United Kingdom have consistently referred to the "charges" made by the Commission. As Colonel Hankey points out, there were neither charges nor conclusions but simply "a statement of the problems which the Committee had examined." These alleged charges, it will be remembered, are the famous six points against private manufacture. As a matter of fact there were also embodied in the subcommittee's examination eight points in favor of private manufacture. In other words, the Committee's deliberations were simply an analysis of the pro and con of the entire subject.

This and every other of the many ramifications of the entire problem have been presented by Colonel Hankey in coöperation with the defense services of the British Government. To attempt a summary of all the testimony would be impossible here. Suffice to say that no one is justified in coming to a satisfactory conclusion on whether or not the manufacture of arms should be a government monopoly or a combination of government and private manufacture until he has studied Colonel Hankey's lengthy review. It is devoid of all emotionalism and deals strictly in facts. Little wonder that the Royal Commission itself arrived at the conclusion that nationalization of arms manufacture in Great Britain is undesirable.

There is probably no other country on the face of the earth where conditions of life, economics, and social outlook are so like our own as those of England. While the British arms industry appears to be considerably larger than our own "small fry," it is safe to say that the principal difference between the two is merely this one of quantity. Hence if there is to be continued agitation and propaganda on this subject so vital to our own national defense, it would be well, indeed it is imperative, that the entire record of the Royal Commission be studied from beginning to end. We have nothing at all commensurate with it in our own country.

OUR esteemed friend and frequent contributor, Maj. Gen. J. F. C. Fuller, delivered a lecture at the Royal Artillery Institution, London, during the latter part of last year, on the development of totalitarian warfare. He contributed an article to this journal on somewhat the same subject two issues ago. His discussion in these pages created some comment among readers both by way of agreement and disagreement as to the element of surprise in the new tactics. Several readers questioned General Fuller's prophecy, based on the development and use of air power, that another European conflict between major powers might be of very short duration. This whole question of air power and what to do with it in relation to the various forms of government, whether they be democratic or totalitarian, needs and needs badly some clear sober thinking. General Fuller is paving the way. This new arm has modified elements of strategy not heretofore conceivable. Ranges of projectiles are increased from miles to entire states, speed from miles an hour to miles a minute, fire power from pounds to tons, and supply from slow-moving trains on land to fast-moving ships in the air. Yet all this is military power of a state to be used in conformity with the economic or political objectives of the state. Use is a matter of intention.

MORAL REARMAMENT

However it may be and whatever may come of it, General Fuller cannot be gainsaid on the closing theme of his lecture at the Royal Artillery Institution. He said, "Either we must radically change our political system, or we must so shape our foreign policy that we are not embroiled in another war. As our politicians refuse to consider the first and as they insist upon adhering to the principles of collective security and almost daily inform us that it is the foundation of our foreign policy, we are faced by a veritable Caudine Forks. What we should do is outside this lecture; yet the fact remains that, bearing in mind the probable nature of totalitarian warfare, technical rearmament, unless it is based on what I will call 'moral rearmament', that is a firm national discipline, is likely in the next war to prove a frail reed to lean upon."

Indeed, moral rearmament is the *sine qua non* which applies to ourselves more definitely than is usually admitted. What with the challenges today being hurled at the very bases of our own national discipline, moral rearmament is a necessity without which technical rearmament is just so much superstructure badly tilted because it rests upon no foundation at all. Our "uplifters" don't seem to realize it.

Justice in War

An Editorial

ONLY the limitation of the line of type in our usual format is responsible for the brevity of the title of this editorial. A more descriptive label would require a great many more words than noncompressible type metal would accommodate, thus a few preliminary paragraphs devoted to a clarification of meaning are warranted. We shall attempt this clarification without hesitation and then proceed to an analysis of some present-day efforts toward justice by taking profit out of war. The very controversial and much-abused question of profit in war is the subject to which this editorial is addressed. There should be some straight thinking about it now.

Justice and war are not contradictory terms as some of our ranting, bellicose pacifists would have us believe. War is such a hideous thing, we are told, that there can be nothing just about it. Moreover, so it is said, those who stand to profit by war—the "iniquitous" arms makers in particular—are the only people who believe that wars can be just. Are not "munitions makers" the fomenters of war, and the prolongers of conflict once it begins? Profit being the only motive, there can be nothing just about war, rants the rabble-rouser. Hence anyone who claims there can be justice in war either in its objective or in its method of prosecution, is simply a dupe of those interests which stand to profit in war.

Before getting down to brass tacks it may be well to get some fundamentals straight for the record's sake, at least, if not for the benefit of those whose vision is beclouded and whose capacity for clear thinking is that of the average mediocrity. Of course there have been, are, and will be, just wars. The three requisites of a just war were set down by moralists centuries ago; time will not dim nor "progress" change, their truth. According to these moralists a war is just when: it is declared by the public authority of the state; when it has a just cause; and when the intention of those who prosecute it is right. These norms have to do with the declaration of war and not its conduct. None the less, there are just wars both in declaration and conduct and, so far as we are concerned here at all, we are concerned only with a just war. Those childish ladies and gentlemen who hold that all war is unjust are simply trifling with ideas which are too simple for people who insist upon the complex approach. Having said this much, we hasten to affirm our pacific intention else the charge of war-mongering will be hurled again as it has been in recent years. Subscribing, as we do, to the epigram "the object of a just war is a more perfect peace", it should be unnecessary to add that recourse to war is a last resort only after arbitration and conciliation have failed. A strange doctrine for the journal of those who may have to make the implements of defense in time of war? Maybe it is, but it has been the doctrine of sane men since the beginning of time, and we stand by it even though some selfish motive be imputed.

FROM the very day the World War ceased, sincere effort has been made to take the injustices out of the conduct of war. The rules of war are much older than men now living. They have to do with the conduct of battle, the protection of noncombatants, the rights of neutrals, and they are still adhered to by commanding generals worthy of the name. But the latter-day concern for removing injustice from war has to do with those steps to be taken in planning for war so that inequalities at home may be removed, burdens equalized as nearly as may be, and profits restricted to a fair and reasonable level. "Taking the profit out of war" is a shibboleth on many tongues which glibly wag their merry way, too often unconscious that any extreme notions—if ever put into effect—would not only take out the profit, but in the end guarantee defeat.

Now to clarify once more: No sane person wants war; if war comes it must be just in declaration and in conduct; every citizen must do his or her full duty and the burdens must be equalized and its profits limited among all, share and share alike. But the main objective is to win the war. These are the principles which have guided sincere students of peace and war in the United States. They are the bases of our National Defense Act and of the findings of the War Policies Commission of 1932. They are definitely a part of the established policy of the War and Navy Departments of the United States and, most assuredly, they are subscribed to by American industry and most components of our national life. The outlook is promising that these policies will be adopted speedily by the Congress of the United States and incorporated into the organic law of the land. Possibly this will be a *fait accompli* before these lines appear in print.

UNDER the sponsorship of the American Legion there was introduced in both houses of Congress on January 6, 1937, a bill "To prevent profiteering in time of war and to equalize the burdens of war and thus provide for the national defense and promote peace". In the Senate the proposed legislation (S. 25) was introduced by Senator Sheppard of Texas, chairman of the Senate Committee on Military Affairs, and was referred to that committee. In the House, the identical bill was introduced by Representative Lister Hill, of Alabama, chairman of the House Committee on Military Affairs and was referred to that committee. The complete text of the proposed legislation as introduced is as follows:

"Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That whenever Congress shall declare war or the existence of an emergency due to the imminence of war, the President is hereby authorized to determine and publicly proclaim it to be unlawful to buy, sell, or otherwise contract for any article or thing enumerated in such proclamation, or proclamations, at a higher rate, rent, price, commission, compensation, or reward than was in effect at a date determined and set forth in such proclamation or proclamations.

"Sec. 2. Whenever in the sole discretion of the President he shall determine that any maximum price, rent, rate, commission, compensation, or reward previously proclaimed shall be adjusted either upward or downward, he is hereby authorized to make and publicly proclaim such adjustment, and such adjustment shall have the full force and effect under this statute of such price, rent, rate, commission, compensation, or reward before such adjustment.

"Sec. 3. That in the event of war, or of a national emergency declared by Congress to exist, which in the judgment of the President demands the immediate increase of the military establishment, the President be, and he is hereby, authorized to draft into the military service of the United States such members of the unorganized militia between the ages of twenty-one and thirty-one as he may deem necessary, subject to such conditions, exemptions, rules, and regulations, as the President may prescribe and publicly proclaim. Likewise, during such time of war or national emergency declared by Congress, the President shall have power to determine and publicly proclaim from time to time the material resources, industrial organizations, and public services over which Government control, including requisitioning materials for use or resale by the Government, shall then be necessary and such control shall be exercised by him through agencies then existing or which he may then create for such purposes.

"Sec. 4. During the period of any war or emergency declared by Congress the President is hereby authorized, when in his opinion the successful prosecution of war renders it advisable, to require, under such rules and regulations as he may establish, the registration of all or any class of persons engaged in the management or control of any industrial or manufacturing establishment designated by him. Thereupon, at his option, such persons registered pursuant to the provisions of this section may be brought into the service of the Government as civilians for the duration of the war under such rules and regulations as the President may prescribe.

"Sec. 5. During the period of any war or emergency declared by Congress the President is authorized to determine, and by public proclamation, or proclamations, announce what classes of public service, real property, or right, or of dealers, exporters, importers, manufacturers, or producers, of any article or commodity shall be required to operate under licenses, to fix the conditions of such licenses, and to grant licenses under such conditions. After such determination and proclamation by the President, it shall be unlawful for any such determined classes to engage in business without such license.

"Sec. 6. During the period of any war or emergency declared by Congress the President is authorized to determine and publicly proclaim the order or priority in which any manufacturer, dealer, producer, exporter, importer, or public service in the United States shall fill orders, or transport anything or furnish power, and after such determination and proclamation it shall be unlawful for any such manufacturer, dealer, producer, exporter, importer, or public service to fill such orders in any other order of priority.

"Sec. 7. That during the period of any war or emergency declared by Congress the President is empowered to create such agencies, boards, or commissions, including the employment of necessary personnel, and to designate agents or agencies to exercise such portion of his powers as he may deem necessary and proper to accomplish the purpose of this Act. Likewise, at such time, he shall have power to make such rearrangements of Executive agencies, and of bureaus and divisions thereof, and to transfer such duties, powers, and personnel as he may deem necessary for the proper conduct of war, or for the meeting of such national emergency.

"Sec. 8. That any person, firm, or corporation violating any of the provisions of this Act, or violating any publicly proclaimed orders, rules, or regulations made by the President for executing the powers contained in this Act, is hereby declared to be guilty of a misdemeanor and shall be liable to indictment and trial therefor, and upon conviction thereof shall be sentenced to pay a fine, not exceeding $100,000, or to serve in prison, not exceeding one year, or both, at the discretion of the court.

"Sec. 9. That upon the declaration of war, and during the period of such emergency, there shall be imposed a tax of ninety-five per centum of all income above the previous three-year average, with proper adjustments for capital expenditures for war purposes by existing or new industries."

COINCIDENT with the introduction of the bill, the following joint statement by Senator Sheppard and Congressman Hill was issued:

"Aiming at the prevention of war-time profiteering, at the drafting of the nation's man power, and at the placing of industry under Federal control during the existence of a national emergency, thus promoting continued peace, we have introduced a bill in both Houses. It is the plan the American Legion has been sponsoring since its national convention held at Kansas City in 1921 and embodies recommendations made in 1932 by the War Policies Commission. A similar bill was introduced by the late Representative McSwain and was passed by the House in April 1935, by an overwhelming majority.

"It is a statement of broad, general policies and is deliberately intended to avoid the mistake of seeking to legislate as to details perhaps many years in advance of the outbreak of a possible war, when the economic and social conditions are unpredictable. With the international situation as it is, and neutrality legislation to the fore, the American Legion has requested its friends in Congress to press for early action of the proposal so that it may be considered as a companion law to the expected neutrality legislation.

"The bill proposes, upon the declaration of war or of a national emergency due to the imminence of war, to authorize the President to determine and publicly proclaim and limit prices; to give him the authority to adjust these prices, when necessary, by public proclamation; to draft man power between the ages of 21 and 31, subject to such conditions, exemptions, rules and regulations as the President may prescribe; and to take into the military service, as civilians, any persons engaged in the management or control of industrial or manufacturing establishments designated by the President. It also proposes to license those classes determined by the President as necessary for the successful prosecution of war; fix priorities of the filling of orders by any manufacturer, dealer, producer, exporter, importer, or public service in the United States; and to grant to the President the power to create agencies, boards, and commissions, and to employ the necessary personnel, all in time of war.

"The taxing provision is severe in that upon the declaration of any war there would be imposed, for the duration of such emergency, a tax of ninety-five per centum of all income above the previous three-year average, with proper adjustments for capital expenditures for war purposes by existing or new industries.

"A severe taxing provision in any 'universal service' or 'industrial mobilization plan' is regarded as absolutely necessary by the sponsors of the proposal. When a similar plan was reported from the House Military Affairs Committee in

February 1935, it was pointed out that while it is not possible to attain the ideal, yet the committee should not be deterred in an honest effort to prevent the 'conscienceless, wasteful, and outrageously extravagant profiteering that went on during the World War period.' At that time it was pointed out that 22,000 individuals 'climbed out of financial obscurity into the class of millionaires, and hundreds of those who were already millionaires saw their fortunes mount higher and higher by the tens of millions, and even hundreds of millions.'

"Bernard M. Baruch, war-time chairman of the War Industries Board, in submitting his conclusions to the War Policies Commission, pointed out that the adoption of a proper plan would allow for the passing of this nation from a peace to a war status, and at the end of the war back to a peace status, with a 'minimum of confusion, waste, and loss'; also that it would reduce the cost of war by fifty per cent and possibly a greater figure. The effort to obtain this legislation has been one of the principal objectives of the American Legion since its inauguration. For a number of years that organization sponsored the language popularly known as the 'Capper-Johnson Bill' but the matter was never reported to the Congress for action. However, in this connection, we call attention to the fact that the substantial parts and provisions of the Capper-Johnson Bill are included in the present proposal.

"Public opinion has become active in demanding this legislation, particularly since the international situation has demonstrated the need for a law which would put this nation on a more sound footing in the event that a major conflict should break out and this country be in danger of involvement. It is our opinion, and the opinion now held by many other citizens of this nation, that war should be made a profitless business and that in the event of a future war a dollar should not be held of greater value than human lives or human suffering. It is also our conclusion that when war ceases to be a profitable business much of the incentive for war will end.

"It will not cost one cent to place the universal-service law upon the statute books. If fortune should bless us, and there be no more wars, its enactment will not affect the life of the nation. But should war come, we can then meet it as all thoughtful people know it should be met, promptly and efficiently by a united nation in arms, through equal service from all, and special profit for none.

"The latest resolution, calling for such legislation, was adopted at the last national convention of the Legion, held at Cleveland in September, and the organization's National Executive Committee, at its meeting in Indianapolis in November placed this legislative resolution on its major program. Immediate hearings will be held on this bill, to which will be invited the national commander of the American Legion, other national officers of that organization, and all other persons interested in the proposal."

HERE then is what we mean by justice in war. Because we fervently hope that conflict of arms for the United States will never again be our lot, we hope even more fervently that this kind of war-policy legislation will be enacted now. It will have a most beneficial domestic effect. Too long has the demagog misled the people about war profits; the time has come to take the wind out of his sails. He has bludgeoned the hustings with his one-sided excoriation, he has painted the arms maker in the World War as the "patrioteer" forgetful that the wheat grower, the cotton planter, the realtor and the corner grocer were equally and frequently more guilty than the manufacturer. It is time that all this sort of class consciousness and class struggle have an end, and that we all turn to constructive, adequate national defense. Surely everything nasty has been said. Let us have such legislation as this Legion bill provides—it will be a good thing for everybody. It is the kind of law every student of our national defense has favored for years. While assuring effectiveness it will also provide justice for all in the conduct of any future war that may be the unfortunate lot of the United States.

So at long last, thanks to these committee chairmen and the Legion, a sensible, sane piece of war-profits legislation is in prospect of enactment. It is to be hoped that the bill with such minor revisions of text as may be required will be passed speedily. The bill has all the merits of justice and military effectiveness. It is a legislative declaration of sound policy as these desiderata have been evolved by the best civilian and military thought of the nation. It provides additional authority of law for the principles of industrial preparedness as they have been developed during the past twenty years. It is not an extremist view but is thoroughly fair to all elements of our people. It will, as its title indicates, prevent *all* profiteering and equalize *all* burdens of war as far as it is humanly possible to do so. Likewise it will provide adequately for the national defense and most assuredly it will promote peace. Lastly, in conformity with its policy-making intent, the legislation is brief and to the point and thus does not attempt to legislate in extreme detail but delegates the application of its principles to the Executive.

Mr. Bernard M. Baruch, chairman of the War Industries Board during the World War and a medalist of the Army Ordnance Association, summed up in simple terms the impelling reasons for the adoption of this bill when he testified in favor of it before the Military Affairs Committee of the House of Representatives on February 4th. After advocating that the text be amended to provide a "ceiling" on all wages and all services as well as on the price of materials, he warned that attempts to prevent war should not wipe out all normal profits; such a policy would break down our industrial machine at the very time it must function most effectively. "The apparent isolation of the United States", said Mr. Baruch, "has always caused us to lag behind in the matter of national defense. Once every generation regularly, we have paid a frightful price for this neglect. A state of armed neutrality can preserve its neutral character much easier than unarmed neutrality can. Who can believe that, had we been ready to fight in 1917, we should have been subjected to English interference and to German insolence that finally made us fight? With a law that would put in automatic operation a mobilization of our vast industrial fighting power, what nation would dare attack us? By enacting such a law as this we shall have written for ourselves the best national peace insurance policy that any country ever had."

A determination to take excessive profits out of war for *everybody* must be the final measure of our sincerety. The master and the servant, the landlord and the tenant, the principal and the agent all must stand on the same level so that justice in war may go hand in hand with effectiveness. Assuming then that the American people will, in the future as in the past, be concerned only with a just war, justice in the execution of that war will be assured by an enactment such as the one proposed. Thus we will attain justice in war.

Association Affairs

COL. CHARLES L. HARRISON

THE Army Ordnance Association announces with deep regret the death of Col. Charles L. Harrison of Cincinnati, Ohio, a member of its Board of Directors since 1919. His loss to the Association is very great. In his passing away the Ordnance Department of the Army is deprived of the services of the chief of its Cincinnati Ordnance District and his fellow countrymen of an American citizen whose service and ability they can ill afford to relinquish. Colonel Harrison died suddenly at his home December 16, 1936, in the seventy-second year of his age.

COL. CHARLES L. HARRISON

The kindly manner and sympathetic understanding which characterized our late associate were symbolic of his lifetime of devotion to social and economic advancement—a service he rendered with unselfish purpose to his native city, his state, and to the nation in peace and in war.

Colonel Harrison was born in Cincinnati, the second son of Learner B. Harrison, founder of the First National Bank of that city. He was educated in the public schools of Cincinnati, at Philip Exeter Academy, and at Harvard University. Upon the death of his father he became manager of the Harrison estate which increased under his wise stewardship and added many fine enterprises to Cincinnati. He rendered conspicuous public service to that city as president of the Board of Sinking Fund Trustees and as an official of many private, charitable, and commercial organizations.

When the decentralized system of ordnance production to meet the military program of 1918 was decided upon, Colonel Harrison was chosen chief of the Cincinnati Ordnance District. The magnitude of this undertaking and the efficiency and effectiveness with which it was conducted are lasting tributes to the genius of the man. Beginning with no organization and no conception of the task, but with a tremendous capacity for hard work and intelligent progress, Colonel Harrison established a record of public service second to none. Describing this early situation Colonel Harrison once wrote: "While it was obvious to the casual observer that the Production Division (of the Cincinnati Ordnance District) had a vast amount of work to perform, the real significance of this work could be understood only by technical men familiar with the difficulties of putting into production products entirely foreign to the contractor's previous line of work and about which little or no technical information could be obtained in this country." With only a borrowed desk in quarters rented by himself, he began the Cincinnati District's share of the national-defense program. By October 23, 1918, his organization consisted of 140 civilians, 5 commissioned officers and 7 enlisted men at Cincinnati, and in subdistrict offices (Dayton, Indianapolis, Muncie, Kokomo, Louisville, and Birmingham) there were 64 civilians, 4 commissioned officers and 7 enlisted men. When the district had completed both its mobilization and postwar demobilization activities it had, under Colonel Harrison's guidance, expended $115,817,297 on a total of 1016 ordnance contracts. Its activities included some of the largest chemical, explosives, and loading enterprises of the war program as well as facilities for the fixation of nitrogen, machine tools and metal products.

THE area over which Colonel Harrison had control included the southern portions of Ohio and Indiana and the entire states of Kentucky, Tennessee, Louisiana, Mississippi, Alabama, Georgia, and Florida—an area of 376,524 square miles with a population at that time of 18,770,197. Reading the record of his performance in this area after eighteen years, the achievement was monumental. Among the hundreds of ordnance items which were produced in quantity, the following few may be singled out: nearly one hundred and ten million billets, over eight hundred thousand drop bombs, some eighty-five million cartridges, one hundred and thirty million shell forgings, nearly ten million fuzes, sixteen million grenades, nearly eight million shell, some ninety million pounds of smokeless powder, and over three million gallons of toluol. The Old Hickory Powder Plant was in Colonel Harrison's district. At this plant alone the remarkable record was established of getting into production seventy-five days ahead of schedule with a developed capacity at the time of the Armistice of four hundred and twenty-three thousand pounds of powder a day.

At the first meeting of the Army Ordnance Association at the Aberdeen Proving Ground, October 24, 1919, Colonel Harrison was presented the Distinguished Service Medal. The presentation was made by the then Assistant Secretary of War, Gen. Benedict Crowell, who has served as president of the Association since that time. The citation accompanying the medal reads: "For exceptionally meritorious service to the Government on duty of great responsibility as Chief of the Cincinnati Ordnance District in which capacity he maintained at all times the greatest degree of intelligent and enthusiastic coöperation between the Ordnance Department and the manufacturers in his district, thereby attaining the maximum production of munitions in a minimum of time, and also as Chairman of the Cincinnati Ordnance District Claims Board in which capacity his services have been invaluable to the nation in adjusting equitably the $153,000,000 worth of outstanding contracts in his district in force at the signing of the Armistice."

With his farseeing vision, Colonel Harrison ascribed to the Army Ordnance Association the important function of carrying on the public responsibility for ordnance preparedness.

"The question is how to keep a nucleus of trained men available for such service in the future," he wrote in February 1920. "The Army Ordnance Association now in process of development is accomplishing this result." Certainly in later years he assisted materially in furthering the Association's purpose.

WE take the liberty of citing two other quotations from Colonel Harrison's journal of the war-time district's work: "It has been the most interesting experience I have ever had and the hardest work I have ever done, although for a quarter of a century I have had the reputation of being a pretty hard worker." And at the very end of the war-time district's responsibility he wrote, in December 1919, "The claims are now almost all settled. But four difficult ones are still in the staff—cost-plus contracts in process of being wound up. Looking back, it is a wonder to the writer that so many claims could be settled in the period, so many difficulties overcome and so few dissatisfied contractors. It is a pleasure to state that in the writer's opinion over ninety-five per cent of the claims were honestly presented."

When the peace-time ordnance district organization was reëstablished in 1922 Colonel Harrison, along with that stalwart band of other district chiefs, undertook and served in his old assignment. In this capacity he continued until the time of his death. Moreover he was one of the organizers of the Cincinnati

Post of the Army Ordnance Association and served as president of that group for several terms. Just previous to his death he had been reëlected for another term of four years as a national director of the Association for the term beginning January 1, 1937.

The passing away of this great man whose capability was second only to his humility, leaves vacant a place, both in official life and in the affections of his friends, which cannot be filled. To his associates of Cincinnati and of the Cincinnati Post, and to all his friends, ARMY ORDNANCE expresses its condolences with a feeling that even greater determination to carry on Colonel Harrison's work for the national defense is the one legacy he would bequeath to us, and in the doing of which we can best revere his memory.

LIEUT. COL. WALTER L. CLARK

LIEUT. Col. Walter L. Clark, one of the best known and best loved officers of the Ordnance Department of the Army, died suddenly on January 13th at his home in Washington, D. C. News of his death will bring to his many friends in military and industrial life a sorrow associated only with the passing of those whose place in the affections is deep and lasting. His calm demeanor, exceptional ability, and kindly disposition had endeared him through many years of military service and had resulted in a large number of lasting friendships. At the time of his death he was executive officer to Brig. Gen. H. W. Schull, Chief of Manufacture of the Ordnance Department, in which office he had served since June 1935.

LIEUT. COL. WALTER L. CLARK

Colonel Clark was born in Vermont, July 4, 1885. He was graduated from the Norwich University, Vermont, in 1909, a Bachelor of Science in Chemistry. After service as captain of Field Artillery in the National Guard of Vermont, he was commissioned a second lieutenant, Coast Artillery Corps, Regular Army, on May 26, 1910. Following service at several Coast Artillery establishments, during which he achieved the distinction of honor graduate of the Coast Artillery School, 1915, he served in France as captain of Coast Artillery, returning to the United States in June 1919. His first station following the World War was as commanding officer of Camp John Hay, Philippine Islands, where he remained until October 1921. In August of that year he transferred to the Ordnance Department. His administrative qualities were at once apparent, and he was assigned to the Aberdeen Proving Ground for a 4-year tour of duty during which he was in charge first of the ballistic section and later of the gun-testing division.

In June 1925, he was ordered to the Office of the Chief of Ordnance in Washington and placed in charge of statistics in the War Plans Section, later to become chief of the Industrial War Plans Section of the Manufacturing Service. This was in the formative days of industrial mobilization planning, and Colonel Clark's approach to the problem was a deciding influence in the policies of this important undertaking in later years. He was graduated from the Army Industrial College June 28, 1930.

His next assignment was as executive officer to the chief of the Philadelphia Ordnance District. Here his sterling qualities as administrator and maker of friends were soon apparent. He participated actively in the work of the Philadelphia Post of the Army Ordnance Association, serving as its secretary for several years. He was well known both among the military and industrial fraternity of Philadelphia. He was particularly active among the Ordnance Reserve Officers and did much to encourage their interest and sustain their zeal in their peace-time studies. To visit any Ordnance function in Philadelphia today is to hear on all sides the highest appreciation of his character and work. He served in this office for four years, from August 1930 to July 1934, when he returned to Washington to assume the duties of the assignment he held at the time of his death. He was promoted to lieutenant colonel October 1, 1934.

It is difficult to assess, if assessment were necessary, the life work of this splendid officer. Of retiring disposition, keen mental outlook, and practical judgment, he represented the very best in the military tradition of the United States. An army at any time can ill afford to lose one of its members of his capability. Thus it is that the military organization of which he was a manly representative, his own Ordnance Department, and the Army Ordnance Association of which he was a charter member, suffer severely by his death. The Association owed him a deep debt of gratitude for the kindly interest he always took in its aims and purposes, and it bespeaks in an especial way the grief that has come to all his friends by his death. Voicing as it believes it can, the sentiments of his many friends in the Association, ARMY ORDNANCE bespeaks its condolences to the members of his family.

ST. LOUIS POST

MAJ. Gen. William H. Tschappat, Chief of Ordnance, was the honor guest and principal speaker at the annual meeting of the St. Louis Ordnance District organization on January 14th. The meeting was held at the Coronado Hotel where an interesting exhibit of ordnance matériel, including the Army's latest type of combat car and field gun with high-speed adapter, was on display. Some 250 diners were present for the banquet over which Mr. M. E. Singleton, chief of the St. Louis Ordnance District, presided. Mr. S. W. Fordyce, a member of the district's advisory board, was toastmaster. Also seated at the guest table were many leading representatives of industry and military affairs in St. Louis.

General Tschappat spoke on the peace-time coöperative effort of industry for adequate ordnance preparedness. He described some of the latest advances in the industrial mobilization activitives of the Department and complimented the St. Louis organization on the work that has been done in this connection. Speaking of the combined activities of the various components of ordnance preparedness General Tschappat said:

"Tonight you have gathered together in a representative group, not capable of division but containing four essential elements all interested in plans for our national defense. Some of you are coöperating in our Ordnance District planning effort primarily as private manufacturers; some of you are affiliated with the St. Louis Post of the Army Ordnance Association; some of you are Reserve Officers; and some of you are particularly active in the civic affairs of your community. The Army Ordnance Association, however, is, I believe, the one common denominator of them all because it seeks to bring together industry and Government, company and individual, civilian and military into one common forum.

"As a charter member of the Army Ordnance Association and as Chief of Ordnance of the Army, I want you to know that I regard the Association as the one common meeting ground for the combined effort of those who, though of diverse interests, recognize the importance to the national defense of keeping alive in the United States knowledge of ordnance and ordnance production. We have only to recall that prior to the last decade the ancient and honorable art of gun making always subsided after a war into an art more or less confined to a few Govern-

ment establishments and technicians employed at these places.

"Now, nearly nineteen years after the World War, the needs and progress of American ordnance are very much alive in the minds of people throughout the breadth of the land. Should we ever have another major emergency, I believe we shall approach it with full coöperation between industry and the Ordnance Department. Our work for industrial preparedness since the World War and the effort of the Army Ordnance Association have made this possible. . . .

"In this district, as in all other Ordnance districts, private industry has coöperated in planning and has made possible our plans for the emergency procurement of munitions. In detailed application, there are and always will be many unusual, almost unsolvable, problems which we will have to face together, but the fact that we are willing to face them together assures, I believe, their ultimate solution. While some delays must be expected in any production program, and particularly in one for a major emergency production of munitions—because of the magnitude of the task itself and the nature of the product—I am convinced that such delays can be and are being minimized by careful planning with the hearty coöperation of the industries involved."

Col. C. T. Harris, Jr., chief of the Planning Branch, Office of the Assistant Secretary of War, described the progress of industrial-mobilization planning, particularly with reference to the latest revision of the Industrial Mobilization Plan. Maj. L. A. Codd, executive secretary of the Army Ordnance Association, also addressed the meeting.

The display of ordnance equipment incident to this gathering met with the enthusiastic approval of all present. It had been arranged by the personnel of Jefferson Barracks in coöperation with the Western Military Academy of Alton, Ill. Various types of small arms and other ordnance equipment were on display. A trophy presented by Mr. Singleton for the best exhibit was awarded to Company H, 6th Infantry, of Jefferson Barracks, Capt. Aubrey J. Bassett commanding. The field gun with modern high-speed adapter was displayed by the Missouri National Guard while the combat car, which was available for inspection, was produced recently at the Rock Island Arsenal. Col. A. G. Gillespie, Commanding Officer of Rock Island, was one of the honor guests at the meeting.

This gathering was one of the most enthusiastic ever held under Ordnance auspices. The genial assistant chief of the St. Louis District, Col. Harry Scullin, was prevented by illness from attending. The elaborate program was under the direction of Capt. H. M. Reedall, executive officer of the St. Louis Ordnance District, who was assisted by a committee of district personnel. It was the general consensus of all present that this banquet and meeting, coinciding as it did with the tenth anniversary of the establishment of the St. Louis Post, A.O.A., was a milestone in the progress of ordnance preparedness in the St. Louis Ordnance area.

PHILADELPHIA POST

MR. Philip H. Gadsden, chief of the Philadelphia Ordnance District, presided at the winter dinner and meeting of the Philadelphia Post and the Philadelphia Ordnance District held on January 12th at the Engineers Club. More than a hundred members and guests, including officials of industrial and military organizations in and about Philadelphia, were present. The principal speaker was Col. J. G. Pillow, Cav., former military attaché at the American Embassy, Rome, Italy. His address was most interesting in that it presented an analysis of the Italian situation with particular reference to the progress and advancement made under Premier Mussolini.

Maj. W. C. Hamilton, secretary of the Philadelphia Post, was in charge of the program assisted by a committee of members of the Post and Reserve Officers attached to the Ordnance district.

CINCINNATI POST ELECTION

MR. Walter W. Tangeman was elected president of the Cincinnati Post, Army Ordnance Association, for the year 1937 in the Post's annual election of officers which was completed on December 20, 1936. A vice-president, four directors and one director to represent the Post in the national Association also were elected.

Mr. Charles F. Hake, Jr., was chosen vice-president and Mr. E. A. Muller, director of the national organization. The following were named directors of the Post for a 2-year term: C. L. Harrison, A. H. Pugh, A. C. Rasmussen and H. C. Pierle. Colonel Harrison, a national director of the Association, died on December 16th, but a few days before the completion of the election. A tribute to his sterling character and his invaluable service as a member of the Army Ordnance Association is published above. Both Colonel Harrison and Major Rasmussen had served as directors of the Post during the previous 2-year term. Colonel Pugh was president of the Post during 1936.

The following directors, elected in December 1935, will continue in office during 1937: Messrs. S. M. Rowe, C. F. Hake, Jr., W. F. Groene and F. V. Geier.

MR. ALEX DOW HONORED

MR. ALEX DOW, chief of the Detroit Ordnance District and a life member of the Army Ordnance Association, was recently awarded the Edison gold medal for 1936 for distinguished service to the electrical industry. The award is made by the American Institute of Electrical Engineers. Mr. Dow has served as chief of the district since 1932. He is a past president of the American Society of Mechanical Engineers.

NEW MEMBERS

THE following recently have been admitted to membership in the Army Ordnance Association: R. G. Adamson, Princeton, N. J.; W. B. Berryman, Jr., Lima, Ohio; George A. Bouvier, Minneapolis, Minn.; George W. Carle, Jr., Ann Arbor, Mich.; Hubert V. Clymer, Vine Grove Ky.; Franklin B. Cole, Los Angeles, Calif.; Emerson L. Cummings, Washington, D. C.; Charles H. Dickson, Orange, N. J.; Valentine S. Doebler, Baltimore, Md.; Donald W. Douglass, Santa Monica, Calif.; George F. Eliot, Brooklyn, N. Y.; W. R. Ellis, Wilmington, Del.; S. W. Gates, Los Angeles, Calif.; William A. Jones, Port Richmond, N. Y.; C. H. Kearny, Princeton, N. J.; John W. Kenny, Forest Hills, L. I.; C. F. Kettering, Dayton, Ohio; Paul Logue, Birmingham, Ala.; George Lutz, Brooklyn, N. Y.; Fred W. Matting, Vallejo, Calif.; Alfred C. Monasseri, Port Richmond, N. Y.; L. F. Moody, Princeton, N. J.; Wall L. Moreland, Burbank, Calif.; J. H. Morris, Princeton, N. J.; R. M. Riblet, Canton, Ohio; Barrett Rogers, Milwaukee, Wis.; Garland T. Rowland, Chicago, Ill.; Clarence J. Smith, Big Bay, Mich.; Harry E. Stone, Norristown, Pa.; Chester S. Stucki, Berwyn, Ill.; James B. Taylor, Jr., New York, N. Y.; E. M. Timby, Princeton, N. J.; W. M. Warner, Princeton, N. J.; Edward L. White, New Haven, Conn.; John C. Whitwell, Princeton, N. J.; C. H. Willis, Princeton, N. J.; T. Edgar Willson, New York, N. Y.; Jacob D. Wilson, Sr., Brooklyn, N. Y.; W. C. Wimer, Princeton, N. J.; Erich R. Zademach, Elizabeth, N. J.; William A. Zinzow, Bloomfield, N. J.

NECROLOGY

NOTICE has been received of the death of the following members of the Association: John Brunner, Chicago, Ill.; W. L. Clark, Washington, D. C.; C. L. Harrison, Cincinnati, Ohio; Clifford M. Husted, Worcester, Mass.; and Frederick A. Wiecking, Indianapolis, Ind. To their relatives and friends ARMY ORDNANCE, on behalf of the membership, extends condolences.

Ordnance In Review

PAST—PRESENT—FUTURE

BY LIEUT. COL. CALVIN GODDARD, *Ord. Res.*

Air Corps engineers went back to the Wright brothers' plane of twenty-five years ago for their latest contribution to the science of blind flying—a "tricycle" landing gear which they said today promised a solution of the problem of making instrument landings with safety. (Associated Press dispatch: Dayton, Ohio, January 2, 1937.)

IN the belief that the records of past achievements hold many long-forgotten secrets, which, when recounted, constitute items not only of real historical interest, but also of practical value to modern ordnance engineers, ARMY ORDNANCE has commissioned Lieut. Col. Calvin Goddard, Ord. Res. to compile the data appearing below and to prepare similar material for subsequent issues. Colonel Goddard, an internationally known authority on arms and ammunition, is the cofounder of forensic ballistics—the science of identifying bullets and weapons when used as evidence in criminal cases. He was formerly the director of the Scientific Crime Detection Laboratory at Northwestern University, Chicago, and of the Bureau of Forensic Ballistics in New York.

Colonel Goddard will supply readers of ARMY ORDNANCE with the authority for any statement made by him. Communications should be addressed in care of this journal and should inclose a stamped, self-addressed envelope for reply.

In his initial contribution to this department, which will become a regular feature, Colonel Goddard presents an illuminating questionnaire containing information on milestones in the history of projectile weapons.—EDITOR.

DID YOU KNOW THAT—

As late as 1593, when shoulder firearms already had been in use for over 160 years, the bow was still more deadly in the field than the clumsy arquebus? In that year, Blaise de Vigenère writes: "And it is a thing on which the best captains of our age are agreed, that the archers and crossbowmen slew more than do the arquebuseers."

The philosopher Michel de Montaigne (1533-1592), wrote that "he thought to see before he died, the abolition of the use of firearms"?

Henry II of France, himself an ordnance engineer of parts, devised a breech-loading arquebus with a hinged breechblock?

Cesare Solatio Romano published in 1669 a work in which he stated that the art of shooting on the wing had then been known in Italy for about eighty years?

Target practice was in vogue at Nuremberg as early as 1429, at Augsburg in 1430, and that by 1450 prizes for practice with the arquebus had been established in various Swiss cities?

The name "cannon" derives from the Latin *canna*—a tube or cylinder?

Mohammed II, in 1452 had a cannon of 27-inch bore cast by Hungarian founders at Adrianople for the siege of Constantinople? Its stone ball projectile weighed 1200 pounds, and to move the cannon required the united strength of 70 oxen and 200 men. Its transport from Adrianople to Constantinople, a normal 36-hours' march, occupied two months. Once emplaced, it was fired but seven times before it burst.

It has been estimated that the same momentum is possessed by a 36-pound iron ball, fired point-blank from a muzzle-loading cannon, as by a battering ram 28 inches in diameter, 180 feet long, fitted with a cast-iron head weighing one and one-half tons, the whole weighing over 20 tons?

The war crossbow had an effective (killing) range of over 200 paces and an extreme range of over 400 paces?

As early as 1548, conservationists were decrying the effect of the introduction of firearms upon the supply of game? In that year, Dominick Boccaurazza, in his treatise on "Sports of the Campagna of Rome", observes that the arquebuseers had so scared the four-footed game that their number had greatly decreased in those parts.

The use of the crossbow was forbidden in France during the observance of the canon of the Second Lateran Council (1139) as a weapon beyond the pale of civilized warfare? Reintroduced by the warlike Richard Cœur de Lion on his return from Syria, his subsequent death, caused by a crossbow quarrel, was attributed by many to divine retribution.

The French General Latrille, a bitter foe of field artillery, held that the use of cannon should be confined wholly to fortress defense, and stated, "I may be deceived, but I think the time will come when it will be only used for that purpose"?

The invention of the first machine for boring cannon is attributed to the Swiss, Moritz (beginning of the sixteenth century)?

So many different types of cannon were already in use by the middle of the sixteenth century that a "Caliber Board" was constituted in an effort to standardize and reduce the total number of varieties to no more than eight?

England lagged behind the Continent in the art of cannon founding, and it was not until the third decade of the sixteenth century (reign of Henry VIII) that a cannon was cast there?

GUSTAVUS ADOLPHUS, early in the seventeenth century decided that his field guns were much too heavy—so he substituted his "leathern cannon"? These were not new, but had been employed by the Venetians in the fifteenth century. As made by Gustavus they consisted of a copper cylinder one-eighth the diameter of the ball and fifteen calibers long. They were closed at the breech by a false or "slip-breech" screwed on with a six-thread screw. Around the powder chamber, they were reënforced by iron rings. They were then enveloped for their entire length with varnish or mastic and wound tightly with cords or canvas. They were provided with iron trunnions, and were finally coated with gypsum and incased in leather! History records that these pieces had a tendency to overheat after ten to twelve rounds, even with very light charges, after which they had to be allowed to cool before further firing.

Gustavus is also credited with having been the first to introduce the practice of loading field artillery with a number of small balls (grape) in place of a single projectile. He was particularly well supplied with ordnance stores, for during his reign many Swedish villages boasted barrelsmiths, each of whom was bound to deliver fifty-two large muskets annually to the Government. Cannon founders in Stockholm and Finspau were prepared to produce pieces of all sizes from one- to forty-eight pounders, and powder mills at Nacka and Wallinge furnished ample powder stores.

When the flintlock began to supplant the wheel lock, there were many die-hards who wished to retain the old form. The celebrated French engineer, Vauban, suggested pleasing everyone by designing a lock which embodied *both* types of ignition, and produced one which proved quite workable.

This spirit of mechanical compromise has been evinced by inventors throughout the entire history of portable firearms. Thus there may be seen today, in museums and private collections weapons combining the firelock (developed circa 1350) with the wheel lock (developed circa 1517); the wheel lock and flintlock (developed shortly after the end of the Thirty Years' War); the flintlock and percussion lock (developed 1807); the percussion lock and pin-fire (developed in the 1840's); the percussion lock and rim-fire (developed in the 1850's); rim-fire and center-fire (developed in the 1860's). Compromise marches on!

Professional Notes

THE ARMY IN 1936

THE following brief extracts from the annual reports of the Secretary of War and the chiefs of arms and services of the Army reflect the problems and progress of the military service during the past year:

The Secretary of War, Hon. Harry H. Woodring: "Stimulated by increased congressional appropriations, the Army pressed forward its program of modernization. This involved the procurement of new and improved equipment for all branches of the service. The advance made was particularly noteworthy in the Air Corps. During the year, several hundred new combat airplanes, of a type at least the equal of the best in the world, were procured. Most of these new planes were required to replace obsolete and worn-out aircraft. However, if the quantity was not increased, the quality was vastly improved. The performance characteristics of the new planes indicate an ever-widening field of usefulness for military aircraft. During the fiscal year which ends next June, approximately 500 new planes will be procured. These will be used to increase the combat equipment of our General Headquarters Air Force and of the air elements of our overseas garrisons.

"A good beginning has been made toward making our ground troops much more mobile than heretofore. Most of our animal-drawn vehicles are being replaced by motors. Several fast new tanks have been built and many more are under construction. Steps are being taken looking to the gradual transformation of our field artillery from horse-drawn to motor-drawn. This necessitates adapting the field guns to high-speed towage. At the same time the guns are being modified to increase the elevation and traverse to make them much more effective weapons.

"Under the directive of Congress contained in the annual appropriation act, steps are being taken to modernize certain of our important coast defenses. This is a field where great improvements can be made, but unfortunately will necessitate heavy expenditures."

THE Chief of Ordnance, Maj. Gen. W. H. Tschappat: "The activities of the GHQ Air Force have created a demand for Ordnance personnel which was not foreseen in the strength assignment of officers and enlisted men and to meet this demand a material increase in personnel should be made. . . . Appropriations for the fiscal year 1936 did not provide for the replacement of ammunition lost through deterioration nor provide for augmenting the stock. Therefore conditions are not as satisfactory as are desired.

"The new light tanks and combat cars designed and manufactured by the Ordnance Department have been favorably received by the using arms. A problem now facing the Department is the relatively high cost of maintaining these and other combat vehicles. Their intricate construction and the nature of their use accelerates wear and causes a much higher rate of expenditure for maintenance than has been the case with non-mechanized types of ordnance. The modernization of light and medium field artillery by adapting the carriages to high-speed transport should not increase maintenance costs and does provide better strategic mobility."

The Quartermaster General, Maj. Gen. Henry Gibbins: A total of 3739 motor vehicles, totaling $4,286,732.51 was purchased by the Quartermaster Corps during the fiscal year 1936 and was distributed as follows: Regular Army, 815; CCC, 427; National Guard, 2004; R.O.T.C., 451; Bureau of Insular Affairs, 3; National Cemeteries, 7; Work Relief, 32.

THE Chief Signal Officer, Maj. Gen. James B. Allison: "A communication Liaison Division of the Office of the Chief Signal Officer was organized during the year to coördinate the procurement, assignment, and use of radio frequencies and call signs throughout the Army, and to coördinate with other governmental departments or agencies matters involving joint or conflicting policies or practices. The pressing problem of the Communication Liaison Division in January 1936, was the procurement and assignment of radio frequencies for the essential peace-time training and operations of the GHQ Air Force. A study of frequency availability indicated that it would be necessary to take advantage of the geographical separation of the several wings of the Air Force and to endeavor to procure frequencies within the required radio set bands which would permit multiple assignment to wings with the least possible interference."

General Allison's report states that during the past year recommendations were made for a change in the operation of all signal communications in the Army except those required for the control of artillery fire and those in airplanes and highly mobile vehicles. "The present system of regimental communications requires that personnel of the Infantry, Cavalry, Field Artillery, Coast Artillery, and Air Corps units operate and maintain complex equipment. This organization of communications has been successful only under especially favorable conditions. Its near-failure is an unflattering contrast to the striking success of commercial communications."

THE Chief of Chemical Warfare Service, Maj. Gen. C. E. Brigham: "Increased effort has been directed toward utilization of potential commercial facilities for the production of chemical warfare matériel, particularly in connection with domestic production of gas masks for use by civilians in time of war. The allowance of gas masks for training was increased during the past year to a ratio of approximately one mask to each four enlisted men. However, thorough training in defense against chemical warfare cannot be accomplished until the desirable goal of a gas mask for every officer and enlisted man is attained.

"As in the past, the Chemical Warfare Service has kept in direct contact with various branches of the chemical industry. This contact is maintained through officers and technical personnel in my office and at Edgewood Arsenal, and especially through the Advisory Committee of the American Chemical Society as well as our civilian consultants. Both of the latter groups have been of particular assistance in this work. In turn, the service has continued to render assistance to the American chemical industry. Whenever practicable, technical data and facilities have been placed at the disposal of those having a legitimate interest therein. Information has been furnished concerning practically every phase of the physiological action and chemical attributes in connection with all phases of chemical warfare."

THE Chief of Cavalry, Maj. Gen. Leon B. Kromer: Recent maneuvers and tests have demonstrated the following: "a. Increased mobility due to: (1) Motorization of trains; (2) Improvement in quality of mounts; (3) Improvement in means of signal communications.

"b. The present allowance of trucks for Cavalry units was based on the strength of the Cavalry prior to the increase of the Army to an enlisted strength of 165,000—additional tonnage is therefore needed due to an increase in both enlisted and animal strength in Cavalry units. Experiments and reports of maneuvers show that this additional tonnage can be furnished in the best and most inexpensive form by providing Cavalry units

with semitrailers as additional equipment. These trailers are most suitable for handling bulky loads such as forage, wood, etc., and are most valuable for the forward movement of animal replacements, the rearward movement of animal casualties, and the quick movement, in special cases, of animals for command and reconnaissance purposes. The need for additional motorcycles has also been shown and requests have been filed for both of these items.

"c. Mechanized vehicles—Maneuvers have demonstrated the value of scout cars to the horse-cavalry regiments and of armored cars to the Cavalry division. On distant and medium reconnaissance, they have reduced the time factor and have done much to relieve the horse of its most arduous task. Study is under way to determine what additional types of mechanized vehicles are required to augment the horse cavalry, to provide mobile fire power for seizing distant terrain, attack of unorganized positions, and pursuit. Equipment for this purpose will be requested as a Cavalry School project.

THE Chief of Field Artillery, Maj. Gen. Upton Birnie, Jr.: "Troop units in the United States are now allotted 201 officers less than are called for by the peace tables of organization, although the increased enlisted strength, when reached, will be more than the tabular peace strength in all cases, while certain units will be at war strength. The morale of the arm is high; particularly heartening is the increase of grades and ratings recently provided by the Congress.

"The new carriage for the 75-mm. (French) gun, M1897A1, was approved standardized as the M2. Its test probably was the most exhaustive ever given artillery matériel in our service, and included road tests of over 4000 miles. The initial lot of new carriages has been manufactured and is being issued to active batteries of the Regular Army. Additional carriages will be manufactured during the fiscal year 1937, and issued similarly."

The 155-mm. howitzer is being equipped with pneumatic tires for high-speed traction and has proved very satisfactory during the past year. All active batteries of this matériel in both the Regular Army and National Guard will be equipped with this howitzer early in the fiscal year 1937.

The Chief of Coast Artillery, Maj. Gen. A. H. Sunderland: "The combination of enlisted strength, decrease in total commissioned strength, and increase in the number of officers on duty other than with branch has resulted in a serious shortage in officers for duty with troops in the United States. While every effort is exerted to maintain an adequate number of officers with troops without depleting other activities too much, it is evident that the only real solution to the problem is an increase in commissioned strength." General Sunderland also urged the organization of six additional antiaircraft regiments.

THE Chief of Infantry, Maj. Gen. Edward Croft: "Production of the recently standardized M2 tank has now reached the point where tangible results can be seen. In contrast to the Infantry having on hand no modern tanks other than a few experimental models, the continuance of the present production schedule will result in equipping all active tank units with at least one platoon of modern tanks by the summer of 1937. Modernization has indicated a need for revision of regulations governing the organization, drill, and tactics of tank units, and studies to this end are being prepared and tested by the Infantry Board.

"The advent of motorization in the Infantry has emphasized the necessity for suitable hand-propelled carriers for auxiliary weapons and ammunition. Seldom, if ever, will motor trucks be able to transport the auxiliary weapons as far forward as desired. Motorization and attendant elimination of animals within regiments have brought to the fore the urgent requirement for satisfactory reconnaissance vehicles or cross-country cars. After a thorough test of types of vehicles for this purpose by the Infantry Board, decision was reached that the most satisfactory type is the light standard commercial 5-passenger phaeton, unarmored and unarmed. Appropriate action has been taken to adopt such vehicle as the standard Infantry cross-country car."

THE Chief of the National Guard Bureau, Maj. Gen. Albert H. Blanding: "Approximately 15,000 motor vehicles are necessary to provide minimum training requirements for the National Guard. Of the motor transportation now on hand, all 75-mm. field-artillery regiments of the National Guard, except three regiments of animal-drawn and one battalion of horse artillery, have been provided approximately sixty per cent of the minimum training needs. All 155-mm. howitzer regiments, all antiaircraft regiments, and all 155-mm. gun regiments have been issued approximately forty-five per cent of the minimum training needs.

"Each signal company has been issued four station wagons and six trucks, 1½-ton, 4 by 4. Each air corps squadron has been issued one station wagon and one truck, 2½-ton. Each engineer regiment has been issued two trucks, 1½-ton, with dump body. Each active ordnance company has been issued two trucks, 2½-ton. Each active motor-repair section has been issued two trucks, 2½-ton. All motor vehicles issued to organizations have the proper military characteristics. In addition, there are on hand in the National Guard, 456 station wagons and 2995 trucks, cargo, 1½-ton, which provide a pool of motor vehicles for each state, sufficient to transport the bulk of the National Guard to and from camp and to permit some training of organizations as motorized units. These pool vehicles are without military characteristics."

EARLY ENGLISH MILITARY BOOKS

BY COL. THOMAS M. SPAULDING, *U. S. Army Ret.*

IN the course of reading or research it often proves desirable, and sometimes necessary, to consult some rare book. In a half dozen American cities one can visit the local libraries with a good chance of finding the book that is wanted, but never with a certainty, and outside of those few cities the chance is small indeed. Possibly the book may be borrowed from a library elsewhere through the very generous system of interlibrary loans that prevails in this country. In that case the first step is, of course, to locate a copy—which may be no easy matter. There are some library catalogs in print, and the union catalog in the Library of Congress, incomplete as it is, has already proved of immense value. But all of these facilities taken together are still far from adequate, so that any census of a group of rare books, however partial and however imperfect, may serve some useful purpose.

Early military books, as such, have never been the subject of any study of this sort. Moreover, not many American libraries have attempted to specialize in such books to any degree. The Library of Congress and the University of Michigan have good collections of them, both English and Continental. The Huntington Library has an excellent collection of those in the English language because one of its subjects of specialization is early English printing; but military books in other languages are lacking. The New York Public Library has many of the Continental books. Our large military libraries, such as that of the Army War College, are adequate as to works of the nineteenth and twentieth centuries, but they have paid little attention to the earlier works. Their means are limited, and they properly devote them to the more immediate needs of their clients. Many of the early military books are actually rare, in the absolute sense, and practically all of them are rare in this country. Except in a very few libraries their number is negligible.

The appended list locates a few copies of a few of these books. It makes no pretense to perfection and does not approach to completeness in even the limited field that it has adopted. But even so, a military student may be enabled to get the book he wants

through this list until it is wholly superseded by the really thorough studies now in progress—one of English books to 1640 and the other of English books between that date and 1700. How soon these may be completed I do not know, but certainly not in the near future.

The writer's list includes books in the English language only. This rules out the great mass of military literature. Moreover, a large proportion of English military books before the Civil Wars were merely compilations or plagiarisms from foreign works, quite inferior to the originals. Their language, however, makes them accessible to all American students, while books in other languages have a more or less restricted usefulness. The limiting date of 1700 has been set for no reason except its obvious convenience. The selection of titles has been somewhat arbitrary. The intention is to include only books that have some substance—those that are really enlightening as to the state of the military art of their time. This rules out books that are merely odd or quaint; those that deal entirely with what were *then* antiquities (such as Greek or Roman); those that are purely historical narratives, giving only incidental side lights on the art of war. This last test has been applied judiciously, however—or perhaps capriciously. Such books as "Monro his Expedition" and Hugo's "Siege of Breda," although narratives, could not well be left out because of the wealth of information they contain—the one as to military life in general, the other as to fortification and siegecraft.

TO make a selection of books it is necessary to have a list from which to choose. So far as the earlier works are concerned, a perfect tool is at hand in the form of M. J. D. Cockle's "Bibliography of English Military Books to 1642"—practically complete in its listing and excellent in its appraisals. From 1643 to 1700 there is nothing to take the place of Cockle's book, so the selection of works of that period has been made in a rather haphazard manner, considerable use being made of the catalog of dealers in rare books.

Copies have been located chiefly through printed sources and the union catalog, supplemented by a very small amount of direct correspondence with libraries. Nothing like a complete census was contemplated. If a certain library is named as the possessor of a certain book, it may be taken that the statement is based on reliable information; but failure to mention a library does not imply that it has no copy, only that this writer knows of none.

No notice has been taken of editions published later than 1700. Very few were ever reprinted after that date for by that time most of them possessed only antiquarian interest. Likewise, when there are several editions of a book before 1700, no attempt has been made to ascertain and indicate which one a particular library holds. Usually this does not matter much, but in some cases the different editions vary considerably, more material being added as the book was reprinted. The omission is merely one of the numerous imperfections of this compilation, one of whose objects, indeed, is to incite others to do better.

Institutions possessing these books and abbreviations used in listing them below are as follows: AWC—Army War College; BostAth—Boston Athenæum; BostPL—Boston Public Library; Bowd—Bowdoin College; Brown—Brown University; ClevePL—Cleveland Public Library; Harv—Harvard University; Hunt—Huntington Library, San Marino, Cal.; Ia—State University of Iowa; Ill—University of Illinois; LC—Library of Congress; Mich—University of Michigan; Minn—University of Minnesota; MtH—Mount Holyoke College; Newb—Newberry Library, Chicago; NYPL—New York Public Library; PatOff—United States Patent Office; Penn—University of Pennsylvania; Trans—Transylvania College; USMA—United States Military Academy; USNA—United States Naval Academy; Wms—Williams College.

Following is the list of early English military books as compiled by the writer, giving names of authors, locations, and an occasional comment:

ALBEMARLE (See Monk). ANDERSON, ROBERT: "The genuine use and effects of the gunne;" 1674; Mich. NYPL. BABINGTON, JOHN: "Pyrotechnica"; 1635; BostPL. Hunt. PatOff. BARRET, ROBERT: "The theorike and practike of moderne warres"; 1598; Hunt. Ia. Mich. BARRIFFE, WILLIAM: "Military discipline: or, the yong artilleryman"; 1635, 1639, 1643 (two editions), 1647, 1661; (does not deal with artillery in the modern sense, but in the old meaning of munitions or military equipment; artilleryman here means soldier.); AWC. Brown. Harv. Hunt. LC. Mich. NYPL. Newb. BARWICK, HUMFREY: "A breefe discourse, concerning the force and effect of all manuall weapons of fire"; 1594; (written to refute Sir John Smythe's arguments in favor of the longbow; Barwick favors the musket); Hunt. BINNING, T.: "A light to the art of gunnery"; 1676, 1689; Harv. NYPL. BOYLE, ROGER, Earl of Orrery: "A treatise of the art of war"; 1677; Bowd. Mich. BOURNE, WILLIAM: "The arte of shooting in great ordnance"; 1587, 1643; Harv. LC. USNA. CAMBRAY, CHEVALIER DE: "The new method of fortification, as practiced by M. de Vauban"; 1691, 1693; (translated from the French by Abel Swall); ClevePL. Harv. LC. Mich. Newb. CATANEO, GIROLAMO: "Most briefe tables to knowe redily howe manye ranckes of footemen . . . . go to the making of a iust battayle"; 1574, 1588; (translated from the Italian by H. G.); Hunt. LC. Mich. Newb. CRUSO, JOHN: "Militarie instructions for the cavallerie"; 1632, 1644; (the standard work on cavalry in its time); Harv. Hunt. LC. Mich. Newb.

DIGGES, LEONARD AND THOMAS: "A geometrical practise, named Pantometria"; 1571, 1591; BostPL. Hunt. LC. MtH. Penn. DIGGES, THOMAS: "An arithmeticall militare treatise, named Stratioticos"; 1579, 1590; Hunt. LC. Mich. Penn. DU BELLAY, GUILLAUME: "Instructions for the warres"; 1589; (translated from the French by Paul Ive; title page attributes authorship to Du Bellay but it is also claimed for Raimond de Fourquevaux.); Hunt. DU PRAISSAC, SIEUR: "The art of warre"; 1639; (translated from the French by John Cruso); Hunt. Ill. Mich. Newb. ELTON, RICHARD: "The compleat body of the art military"; 1659; 1668; BostAth. Harv. Hunt. LC. Newb. FISHER, THOMAS: "Warlike directions or the souldiers practice"; 1634, 1643, 1644; (no copies located). FOURQUEVAUX (See Du Bellay). GARRARD, WILLIAM: "The arte of warre"; 1591; Hunt. GAYA, LOUIS DE: "The art of war"; 1678; (translated from the French); Harv. Mich. GAYA, LOUIS DE: "A treatise of the arms and engines of war"; 1678; (translated from the French); NYPL. HEXHAM, HENRY: "Principles of the art of militarie"; 1637, 1642; Mich. Newb. HEXHAM, HENRY: "Second part of the principles of the art military"; 1638, 1642; Hunt. Mich. Newb. HEXHAM, HENRY: "The third part of the principles of the art military"; 1640, 1643; Hunt. Mich. Newb. HUGO, HERMAN: "The siege of Breda"; 1627; (translated from the Latin by Henry Gage, an Englishman who had served with the Spanish during the siege; another translation by one Barry was published the same year, but is inferior to that by Gage.); AWC. Hunt. Mich. LA NOUE, FRANÇOIS DE: "Politicke and militarie discourses"; 1587; (translated from the French by E. A.); Hunt. Newb. LUCAR, CYPRIAN: "A treatise named Lucar Appendix"; 1588; (a supplement to Lucar's translation of Tartaglia); Newb. LUPTON, DONALD: "A warre-like treatise of the pike"; 1642; Hunt. MALTHUS, FRANCIS: "A treatise of artificial fire-works"; 1629; (translated from the French by the author); Hunt. MARKHAM, FRANCIS: "Five decades of epistles of warre"; 1622; Hunt. LC. Mich. MARKHAM, GERVASE: "The art of archerie"; 1634; Hunt. LC. Newb.; "The souldiers exercise"; 1639, 1643; (made up of three parts which had been published previously under the titles "The souldiers accidence," 1625; "The souldiers grammar," 1626; and "Second part of the souldiers grammar," 1627); Hunt. Mich. Trans. MENDOZA, BERNARDINO

DE: "Theorique and practise of warre"; 1597; (translated from the Spanish by Edward Hoby); Hunt. LC. Newb. Wms. MONK, GEORGE, DUKE OF ALBEMARLE: "Observations upon political and military affairs"; 1671; (written in 1646 and long unpublished); LC. Mich. Minn. MONRO, ROBERT: "Monro his expedition with the worthy Scots regiment called MacKeyes Regiment"; 1637; (The regiment was raised in 1626, was first in Danish and then in Swedish service, and was nearly wiped out at the battle of Nerlin in 1634.); Hunt. LC. Mich. Newb. MOORE, JONAS: "Modern fortification"; 1673, 1689; Mich.

NORTON, ROBERT: "Of the art of great artillery"; 1624; (no copies located); "The gunner"; 1628; Harv. Hunt. Mich. Newb. NYPL. USNA. NORWOOD, RICHARD: "Fortification or architecture military"; 1639; LC. NYE, NATHANAEL: "The art of gunnery"; 1647, 1670; Mich. NYPL. ORRERY (See Boyle). PROCTOR, THOMAS: "Of the knowledge and conducte of warres"; 1578; Hunt. Mich. ROBERTS, JOHN: "The compleat cannoniere"; 1639; Hunt. ROE (See Watts). ROHAN, HENRI DE: "The complete captain"; 1640; (translated from the French by John Cruso); Hunt. Ill. Mich. Newb. S., CAPTAIN J.: "Fortification and military discipline"; 1688; Hunt. LC. NYPL. SMITH, THOMAS: "The art of gunnery"; 1600, 1628, 1643; Harv. Hunt; "Certain additions to the booke of gunnery"; 1601, 1627, 1628; Hunt. SMYTHE, JOHN: "Certain discourses concerning the formes and effects of diuers sorts of weapons"; 1590; (includes a full discussion of the relative merits of firearms and the longbow, with strong preference for the latter); Hunt. LC. Mich.; "Instructions, observations and orders mylitarie"; 1595; Hunt. LC. Mich. STONE, NICHOLAS: "Enchiridion of fortification"; 1645, 1669; LC. Mich. STYWARD, THOMAS: "The pathwaie to martiall discipline"; 1581, 1582, 1588; Hunt. LC. SUTCLIFFE, MATTHEW: "The practice, proceedings, and lawes of armes"; 1593; Harv. Hunt. Mich.

TARTAGLIA, NICCOLO: "Three bookes of colloquies concerning the arte of shooting in great and small peeces of artillerie"; 1588; (translated from the Italian by Cyprian Lucar); Newb. VAUBAN (See Cambray). VERNON, THOMAS: "Military and Maritime Discipline"; 1672; Mich. WARD, ROBERT: "Animadversions of warre"; 1639; Hunt. LC. Newb. USMA. WATTS, WILLIAM: "The Swedish Discipline"; 1632; Hunt. Mich.; "The Swedish Intelligencer"; 1632-1634; Harv. Hunt. Mich. Newb.; (A series of fifteen pamphlets, attributed to either William Watts or Thomas Roe, appeared between 1632 and 1639, giving current history of the Thirty Years' War and, (incidentally), much information on military practices. The first was entitled "The Swedish Discipline," and the next four "The Swedish Intelligencer," parts 1-4.). WHITHORNE, PETER: "Certain waies for the orderyng of souldiers in battelray"; 1562, 1573, 1588; Hunt. LC. Mich. Newb. WILLIAMS, ROGER: "A briefe discourse of warre"; 1590; Hunt. LC.

QUALIFICATIONS OF AN ORDNANCE OFFICER

(This is from an unpublished manuscript by Gen. Thomas S. Jesup, who was Quartermaster General of the Army from 1818 to 1860. The original is now in the library of the Washington Cathedral.)

THE obvious method of ascertaining what ought to be the qualifications of an Ordnance Officer would seem to be to draw as nearly as possible the picture of an arsenal in full operation, and then to look into the nature of the business and constructions progressing in its several departments, and thence to draw an inference as to the qualifications which such officer ought to possess.

To do this we will enumerate the several departments into which an arsenal in full operation may be said to be divided, and by short inferences, from the nature of the work progressing in each of these, endeavour to arrive at the qualifications referred to.

The Armorers' Shop. In this are made the repairs of all kinds of small arms, as muskets, rifles, carbines, pistols, swords, etc., and here also is conducted the process for their preservation, and for the proof and inspection of those which are undergoing repairs.

Under this head it is obvious the officer ought to have an intimate knowledge, practical and scientific, of the principle of the construction of these arms, of the materials, *viz.*, iron, steel and wood of which they are composed, of the method and means for their preservation; and of the various causes of injury to which they are liable.

If he has not this information, how shall he judge of the fitness of the agents whom he employs in this business? Or if they be qualified agents, how can he guard against the effects of negligence and fraud which may lead to immense losses to the Government?

Blacksmith Shop. In this all the forging of the post is done. Among other irons it includes all those for the carriages of the field train; *viz.*, 6-pdr., 12-pdr. and 24-pdr. howitzer and their caissons, and for the siege, garrison, and seacoast carriages, and for the beds of field and seacoast mortars. It includes also all those irons entering into the construction of the equipage of the field and seige trains, and into that of the seacoast and garrison carriages.

This short sketch will show the wide range, and the extreme importance of the duties of this Department. All these irons require to be of a peculiar form and construction, agreeably to exact dimensions, which are communicated to the men by the officer; a separate draught being in many cases given to the men upon a board to work by. All the orders—all the instructions pass through the officer; he is responsible for everything. Hence he must not only be acquainted with right line-drawing, and consequently of geometry, and descriptive geometry, but he must know the reason for each variety of construction, and for what purpose, and in what manner it is specially necessary as constituting a part of any particular carriage.

Hence it is not only necessary that he should have a knowledge of the general construction of these carriages, but he should also understand the manner in which they are affected by every variety of movement to which they are severally liable in service. Hence too, it is apparent that a knowledge of mechanics is necessary. And when the remarkable difference in the qualities of iron as manufactured in different sections of the country is remembered, the necessity of practical and chemical knowledge in this regard is equally apparent.

Turners' and Filers' Shop. In this, all the filing and turning is done. Among the articles submitted to these operations we may mention a few—as the filing of all such irons as come from the forgers for this purpose. The cutting of screws. The turning of spindles for axles, of wood and iron, for the field, seige, garrison, and seacoast service—of rollers—models and patterns for castings for various purposes—of shot blocks for field service, for round shots, spherical case, canister, etc., of fuzes for all the calibers of shells, and of sponge and rammer heads, for all calibers of guns. Hence the necessity of a thorough knowledge of every description of gun carriages is again apparent: and hence also the theory and practice of gunnery, as regards the application of fuzes to shells, and of these blocks to the several sorts of projectiles for field service must be known.

Carriage Makers' Shop. In this, all the woodwork of the gun carriages, mortar beds, etc., before alluded to, is executed according to draughts, and instructions furnished by the officer. Here it is necessary for the officer to apply his practical geometry in laying off the dimensions in constructing the various patterns to govern the workmen. The same general reasons heretofore mentioned evidently apply under this head.

Carpenters' Shop. In this is executed all the woodwork used in the construction and repair of arsenals, magazines, and other

buildings, and this leads us to consider the qualifications necessary for those who superintend the construction of these buildings. Magazines and arsenals are buildings of a peculiar construction, and are required to be of the most solid and durable fabric and materials. Here therefore the principles of carpentry, scientific and practical, require to be brought into operation, and to do this, a knowledge of drawing, algebra, descriptive geometry and mechanics are necessary. Without the aid of these sciences the work may be *done*, after *some manner*, but it will be done badly; it will (be) unsuited to the purpose for which it was intended, and at the same (time) be a heavy expense to the Government. Under this head, also, we see the necessity for the exercise of a discriminating judgment in all the business transactions growing out of the execution of such work.

Harness Makers' Shop. In this is manufactured all the leather apparatus, applicable to the purposes of war. Such for example, as are used for equipments in field and heavy artillery, and for accouterments for the Infantry of the Line, the Light Infantry, and Cavalry, and for corresponding corps in the Militia.

To manufacture these implements and accouterments in the best manner, it is necessary that the reasons for their different construction should be perfectly understood; and in order that this may be done, a knowledge of the different circumstances under which these several corps are liable to act on the march and in the field is necessary.

Laboratory. In this, all kinds of ammunition are prepared for artillery and small arms: for the charging of signal and war rockets, shells, carcasses, fire balls, etc. Under this head there are a great number of details requiring the closest attention of the officer; such for example, as all those connected with the proof and inspection of the powder, sulphur, niter, and charcoal: the weight of the various charges, for grape, for canister, round shot, for spherical case, etc.

Hence it is obvious that in order to know the reason of these different constructions, and to be able to judge of the qualities of the materials of which they are composed, a knowledge of practical gunnery, and consequently of mathematics, and also of chemistry, is indispensably necessary.

General Business of the Officer. This consists in enforcing on all persons in the public service the steady pursuit of some general system of employment; in the frequent overhauling of ordnance and ordnance stores with a view to their preservation (Here it will be considered that in a Department, which has nearly thirteen millions of property, these examinations are indispensable.); in making draughts, calculations, and statements to govern the workmen; in the making of contracts and agreements for all kinds of supplies as of timber, lumber, stones, iron, shell, etc., and in the inspection and reception of these supplies, with the disbursements consequent upon them.

From these several statements, some idea (tho' I confess a very incomplete one) may be formed of the nature and extent of the duties required of an Ordnance Officer; and by knowing these, we are enabled to give some judgment of what ought to be his qualifications. And in regard to these I would say generally that the habits of an Ordnance Officer should be temperate, studious and investigating while they are active, industrious, steady and perservering. As to his education, he should be principally scientific; he ought especially to be well informed in mathematics, drawing, and descriptive geometry; and also in natural philosophy, chemistry, and the French language. In addition to these qualifications he must have a fondness for his profession. This is considered indispensable. Without this the multiplicity and complicacy of his duties would only serve to harass him, while with the best intentions on his part, the public service would be constantly liable to serious injuries.

Washington, April 19, 1832.

To utilize more weight for arms and armor the two new battleships to be laid down by the U. S. Navy will be powered through steam-driven mechanical gears rather than by electric drive.

ORDNANCE RESERVE TRAINING

BY E. A. WAGNER, *Maj. Ord. Res.*

IT has been my privilege to be associated with the Ordnance Department for a number of years, and during that time, I have tried to study and become acquainted with the functions of the Department in relation to the other branches of the service.

Active-duty assignments have been given in the Army Industrial College in Washington, also in the Massachusetts Institute of Technology, Boston. The work assigned at both these places was very instructive and applicable to the functioning of the Ordnance group, but the feeling was, after the termination of the period, that there was something missing. Just what this was, I could not diagnose, but it seemed to be a lack of the contacts one expects in an immense organization like the Army, although the Ordnance Department is, without question, a very important branch of the service.

Recently, some of my friends in the National Guard asked me to go to camp with them. To clear the routine for authority to do so, attention was called to A. R. 140-5, par. 63 C, which provides that a Reserve Officer can obtain training at his own expense, or without expense to the Government, provided he obtains consent of the commanding officer, through proper channels.

Having obtained this permission, I was in attendance in camp last summer with the 104th Massachusetts National Guard Regiment, Col. A. MacDonald commanding, at the Massachusetts Military Reservation at Falmouth. The experience has indicated to me that a great deal of benefit would accrue to Ordnance Officers if they could have an opportunity to associate with field troops, and observe how they used the equipment for which the Ordnance Department is responsible. One learns the importance of having suitable equipment for every man in the company, and that equipment in the right condition.

Of course, in times of peace, it is not a hard problem to fit out a few thousand men, but our Reserve organization is not intended to function in peace, but in war. If we do not function properly, then it is just too bad, not so much for the Ordnance Officer, but for the fellow who is at the front and who has no chance to correct errors made far in the rear of the firing line.

Another lesson which is illustrated by troops in the field is that of organization. It may be that the Ordnance Officer does not have to look forward to controlling companies and battalions of men in uniform, but he will have to organize companies and battalions of inspectors and other civilians properly to facilitate the production of great masses of Ordnance matériel required for the troops.

Another lesson is the importance of good fellowship among Reserve Officers. The officer who fails to play the game with his fellow officers is sure to receive an extra share of criticism when his sins are poured forth at the daily meeting of all of the officers.

An Ordnance Officer assigned as an observer with field troops can learn as much in a week about the handling of Ordnance equipment as he could in a month of the ordinary active-duty assignment. In time of emergency, his job is to see that the field troops are supplied with certain equipment, and a knowledge of the actual usages should be an incentive to get the wheels, which he controls, under motion at a rapid and accurate rate, so that the troops would not have to wait months and years to have their needs supplied.

CORRECTION

TWO references published in the article, "The Passing of the '86" by Allen P. Wescott, in the January-February 1937 issue of ARMY ORDNANCE (Vol. XVII, No. 100, page 239) are in error. The caliber of the new Winchester 71 rifle is .348 and not .357 as published. Further, the large cartridge, for which a few of the 1876 rifles were made, is a .70-150, not .70-140. We regret these typographical errors in an otherwise interesting contribution to the literature of American rifles by this commentator.

Ordnance Field Service

Army Ordnance Service, Part III

By Lieut. Col. Raymond Marsh, *Ord. Dept., U. S. Army**

IT is not my purpose at this time to go into the operation of an ammunition supply depot to any extent. Let me point out, however, that an Ordnance ammunition company, like all other Ordnance troop units, possesses a dual organization, one for military operation and a second for the performance of its special technical missions. In general, the technical organization of an ammunition company will include an administrative division and an operating division. The administrative division will probably include two sections—one charged with military administration of the company and the other with the assignment of personnel within the depot, the maintenance of the depot records and the operation of the prescribed method of replenishment. The operations division, in general, includes a magazine section and a general-service section. The magazine section includes a control group which is in general charge of the layout of the depot and attached labor and transportation and is responsible for the safe storage of the ammunition. In addition to this control group, there will be several ammunition-handling groups who are concerned largely with the supervision of additional labor attached to the depot and the storage and issue of the ammunition assigned to that group. The general-service section includes such smaller groups as transportation, labor, guard and traffic control.

The only Ordnance maintenance unit organically a part of the army troops is one medium maintenance company which, under present practice, is charged with the primary mission of establishing and operating an army small-arms repair center. It has always been my opinion that if, for the army as a whole, with all its component corps troops and divisions, there is need for an army small-arms repair center, there is an equal need for an army artillery repair center and for an army automotive repair center. The history of the small-arms repair centers which were established and operated in France indicates that these repair centers collected and repaired and evacuated more small arms to the rear than they forwarded to the front. This, however, is not true of the automatic weapons where the supply was limited, the use heavy, and the casualties high.

No other repair facilities are provided organically in the army for the maintenance of the arms and other Ordnance equipment of the army special troops, the army artillery—of which the major unit is a brigade of antiaircraft artillery—and the several army services which include several Engineer pontoon units equipped with Ordnance tractors, and the other Ordnance companies in the army Ordnance service. The Ordnance matériel in the organic army troops appears to be of such variety and quantity as to render highly desirable, if indeed not absolutely essential, the inclusion in army troops of an Ordnance maintenance company capable of performing generally all Ordnance maintenance missions on all types of Ordnance matériel.

Be that as it may, however, there is but one maintenance unit now provided and we must limit our considerations to that one unit. This one Ordnance company, like the other units of the army Ordnance service, is under the technical control and supervision of the army Ordnance officer. It is a part of the army service trains and as such it is controlled by the army administrative orders. Within the scope of these orders it is controlled in accordance with the approved army Ordnance plan. The assignment of this company to its place in column on the march, or to a bivouac, is usually made upon the recommendation of the army Ordnance officer and so indicated in the appropriate army orders. Generally speaking, it sets up for operation where local facilities may be utilized to the utmost. Whenever possible, it should be located near an army Ordnance general supply depot. In the event that more than one Ordnance general supply depot is established, this company is so organized that it may divide and operate small-arms repair centers in close proximity to the several general supply depots.

This Ordnance unit, like all other units, has a dual organization—one for its military operations and another for the performance of its special technical missions. The technical organization of this medium maintenance company is comparable to that of the Infantry division Ordnance maintenance company, which has been described in a previous discussion (Army Ordnance, January-February, 1936, Vol. XVI, No. 94, page 245, and March-April, 1936, Vol. XVI, No. 95, page 307).

The army Ordnance officer may recommend—and his recommendations may be put into effect through the regular command channels—the grouping of Ordnance maintenance companies of lower echelons at places where they can render the most effective and efficient service. This applies, particularly, to the heavy maintenance companies of the corps and to such maintenance companies as may be attached to reinforcing troops from the GHQ reserve. Grouping of maintenance companies is desirable wherever practicable. When the military situation approaches stabilization, it will frequently be found that the corps heavy maintenance companies, and occasionally maintenance companies from GHQ reserves, may be so grouped as to operate what are practically army artillery repair centers and army automotive repair centers.

INSPECTION plans and functions comprise an important part of the missions of the army Ordnance officer. Organizations arriving in the initial concentration of an army, or arriving initially in a new concentration area of the army, after being transferred thereto from some other location in the theater of operations, will generally have their complete Ordnance matériel. Nevertheless, to determine the completeness and condition of this equipment, the necessary inspections should be made. This includes not only the inspection of Ordnance matériel in the hands of army troops, but also the inspection of matériel in the hands of the component corps troops and divisions of the army. The Ordnance personnel available directly to the army Ordnance officer for this inspection mission is so limited that he must either call upon subordinate units for personnel to assist him in making these inspections, or delegate to these subordinate units those inspection functions. It is far better for the Ordnance officer to call upon subordinate units for personnel to assist him in making these inspections because he thereby retains his responsibility for these services instead of delegating that responsibility to subordinate units. Requests for such personnel, and arrangements of all inspection programs, etc., must be made through the army G-3 and army G-4. Their approval of these recommendations for the army commander constitutes the necessary authority for making the inspections. Inspecting should be a continuing function and no opportunity should be lost to inspect the Ordnance matériel of an organization whenever necessary and whenever combat conditions permit.

It is a fundamental principle of Ordnance maintenance that repairs shall be effected as close to the troops as possible, consistent with the availability of time and the availability of facilities. Accordingly, we find that the bulk of maintenance work is done by the medium maintenance companies pertaining to the divisions and artillery brigades. These medium main-

*This discussion presents the personal views of the author and does not represent official policy on the subject.

tenance companies are supported by the heavy companies of the several corps by making available to the medium maintenance companies a larger and more elaborate machine-tool equipment. When repair work which is thus initiated by either the medium or heavy maintenance companies is beyond the capacity of their equipment to repair, or not repairable within the time available, this unserviceable matériel must be evacuated to the communications zone. This evacuation is done through the army Ordnance service installations. It either receives the unserviceable matériel or, upon the receipt of a request for its evacuation, makes arrangements for its transportation and clearance to the rear through the regulating station. Normally, this evacuation is by corps and divisions to their respective railheads and then by rail to the communications zone, using for this purpose the emptied transportation of the daily train. In some cases, it may be necessary for this evacuation to be effected by truck. In this case, the army Ordnance officer must make arrangement with the army Quartermaster for the necessary services where Ordnance personnel and facilities are not available.

No discussion of army Ordnance service would be complete without reference to salvage. The current edition of the Staff Officers' Field Manual provides that the installation and operation of a salvage service is one of the duties of a unit Quartermaster. This same manual provides that one of the duties of a unit Ordnance officer is that of salvaging Ordnance matériel. Existing rules and regulations with respect to salvage are in a very confusing, somewhat contradictory, and scattered state, but nevertheless, enough authority actually exists, or may be implied, for the salvage of Ordnance matériel by Ordnance agencies wherever that matériel may be found. As has been brought out in previous discussions, large amounts of individual equipment, etc., are normally salvaged in division areas. In the trail of advancing troops additional quantities of Ordnance matériel of all kinds will be found. These of course should be collected, made serviceable when practicable, taken up in the stocks of general supply depots and held to meet the call of the using services. If they are beyond repair within the limitations of the army facilities, or are of a type for which the army will have no need, they should be promptly evacuated to the rear.

In addition to the salvage of Ordnance matériel, Ordnance personnel are charged with "the custody of captured enemy ordnance." This matériel will be found in the trail of advancing troops and will consist of either equipment abandoned by the retiring enemy or stocks of captured enemy depots. Here, again, as in the case of our own matériel, such items as may be used by our own troops should be held for such calls, otherwise they should be promptly evacuated.

Due consideration having been given to all these numerous foregoing facts and factors, and a decision having been reached as to how best to solve each of the several problems, the Ordnance officer is prepared to submit his recommendations to the army G-4 for the Ordnance section of the army supply plan. With the approval of these recommendations, after such modifications and adjustments as may have been necessary and their publication in the appropriate army orders, the way is cleared for the Ordnance officer to establish and operate the army Ordnance service. Special care must be taken by him to insure that the several Ordnance units under his control receive the necessary instructions so that they may carry out promptly and properly their part of the plan and its execution.

LET me briefly summarize the points that must be covered in the army orders covering the establishment and operation of the army Ordnance service. With respect to ammunition supply, the refilling points must be indicated by depot designation, including their location, the hour of opening, and the troops to be supplied therefrom. The same points must be covered with respect to Ordnance general supplies. The level of stocks to be maintained in both ammunition and general supply depots must

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be indicated. Information must be given with reference to the method of replenishment of Ordnance supplies and ammunition, whether by requisitions, on the basis of credits, or through the medium of allocations. The routing and methods of the evacuation of unserviceable Ordnance matériel must be covered. It is necessary to include a provision as to the time ammunition expenditure reports will cover and the time and frequency of their submission. Information must be included covering the dates, places, and quantities of labor and motor transportation required from the army Quartermaster service. Any instructions concerning the Ordnance units in subordinate echelons of the army must be included.

Ordinarily, instructions with reference to inspection programs, etc., are covered in a series of technical instructions which indicate the requirements for personnel from subordinate units, and the subordinate unit Ordnance officers who will assist in making these inspections, and general instructions as to repair or disposition of such unserviceable matériel as may be found.

The instructions to the ammunition companies and the depot companies must contain definite information as to what depots these several companies will operate, their location, their time of opening, the initial stocks and stock levels, and the units supplied by each depot. A schedule of arrival of the trains carrying their initial stocks must also be given. Should it be necessary to lay out the depots so as to provide for the simultaneous loading of an unduly large number of trains, instructions to this effect should be included. The requirements as to the submission of information with respect to railroad sidings, labor and transportation requirements, and Engineer, Signal, and Medical supplies and services required for the companies should also be included. It is needless for me to point out that references to locations, etc., should be based on the approved maps, and their titles and scales definitely indicated.

This discussion indicates that the job of an army Ordnance officer is no small job. That is absolutely correct. The importance of any Ordnance job varies almost directly with the size of the unit served. As the size of the unit served varies, so we find a variation in the relative importance of planning and operation. The army Ordnance officer is primarily a planning officer while the Ordnance officers in lower echelons are primarily operating officers executing the plans of the higher echelons.

Editor's Note: This concludes Colonel Marsh's series of articles on Ordnance Service. The series began in the November-December 1936 issue. Part II was published in the January-February issue.

Beginning in the next issue, May-June 1937, the author will present a discussion entitled "Field Service Problems"—a subject of especial importance dealing with the supply and maintenance in service and in storage of all matériel stored and issued by the Ordnance Department of the United States Army.

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Chronicle

THE report of Maj. Gen. Upton Birnie, Jr. to the Secretary of War, recounts the following developments in the field artillery of principal foreign nations during the past year:

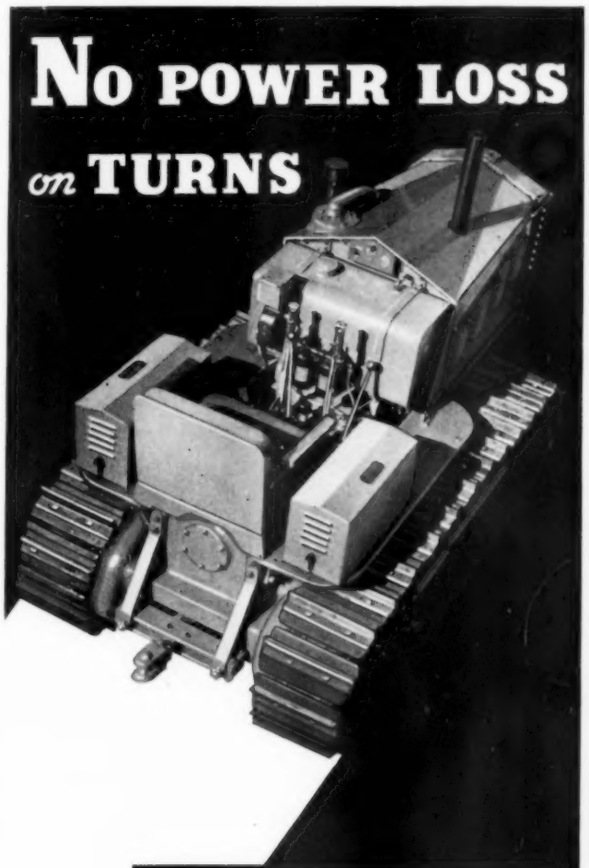
In France "twenty-two per cent of the division artillery now is motorized, whereas in 1934 the proportion was slightly under three per cent. The total number of batteries of division artillery has been reduced from 184 to 140. The 155-mm. howitzers of divisions and corps still are horse-drawn. Changes are affected largely by considerations of economy."

The motorization of Great Britain's forces has gradually increased except for the forces in India. "British practice in motorization is unique in that a 2-wheel transport wagon, similar to our limber, is inserted between the prime mover (a full-track tractor) and the piece."

For Japan, the report lists no new developments in weapons, technical methods, or motorization. "The total artillery of divisions has been increased from 136 batteries of 75-mm. guns and pack howitzers and 105-mm. howitzers, to 225 batteries. Army artillery has been increased slightly. Japan has no corps organization."

In Germany "reports indicate that the new infantry division artillery consists of two regiments, one light and one medium. The light regiment is of three battalions (nine batteries, thirty-six pieces) of 105-mm. howitzers; it is horse-drawn. The medium regiment is of two battalions, one horse-drawn and one motorized. Each battalion has one battery of 105-mm. guns and two batteries of 150-mm. howitzers, a total for the battalion of twelve pieces and for the regiment of twenty-four pieces. Thus the division artillery consists of sixty pieces of 105-mm. and 150-mm. caliber. The weapons of the medium regiment are of new type. The carriages for both the guns and the howitzers are identical. The weight of either weapon in the firing position is about 13,000 pounds. The carriage permits forty-seven degrees of elevation and sixty degrees of traverse; it has no shield. The tubes are unusually long, the maximum range being 20,000 yards for the gun and 15,000 yards for the howitzer. The prime movers of the motorized units are half-track tractors, with seats for the gun and crew."

METHODS of transport in the divisions of the Italian Army include pack mules, animal draft, and motors, according to General Birnie's report. "Diesel engines are being tried out for heavy trucks, since the fuel oil necessary is obtainable from the Sicilian and Abruzzian asphalt bases. Six army corps have been using a special alcohol-base carburant for about two years. A ¾-ton truck capable of ascending forty-two per cent grades has been developed; the engine is air-cooled; there is a device to prevent backward roll; steering, driving, and braking are by all four wheels. The Pavesi tractor for light field artillery, now under test, is particularly adapted to difficult terrain, and is said to be capable of twelve miles per hour on unimproved roads. It has large wheels with folding paddles. Data as to the extraordinary experience of the Italians in Ethiopia are not yet available in complete form. It is known, however, that despite the large degree of motorization, many animals were used. In one instance, the Italians transported 1000 tons of supplies a distance of 1000 kilometers in 17 days by 760 airplane flights. Animal draft was not used, the roads being employed for motor transport and the trails for pack transport. Camels, asses, and mules were



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used, the number of mules reaching about 70,000. The Italian mule was regarded as superior to the American. Forage was shipped from Italy. Pictures of Italian weapons, tanks, and vehicles emphasize low relief."

An "Academy of Motorization and Mechanization" has been established by the Russians for company officers, the report states. Two thousand students are enrolled and are being taught by a corps of 350 instructors. The 4-year course includes such subjects as general engineering and artillery gunnery.

From this study of foreign field artillery, General Birnie draws the following conclusions:

"Motorization increases. The political situation in many countries demands the ready availability of special military vehicles, as contrasted to the American policy of adapting military needs to civil practice. The trend is toward heavier artillery with the division. The continued study of sound-ranging, notably in Germany, Russia, and Turkey indicates that the possibility of stabilized situations is not overlooked in striving for mobility."

MAJ. GEN. DOUGLAS MACARTHUR, Military Adviser to the Philippine Government and former Chief of Staff of the U. S. Army, is expected to arrive in Washington about February 20th accompanied by Manuel Quezon, President of the Philippine commonwealth. The purported purpose of General MacArthur's trip is to support President Quezon's proposal that the United States establish a permanent Philippine naval base.

Sir Arthur William Johns, in charge of Great Britain's submarine building program during the World War, died on January 13th at the age of 63. An authority on submersibles, he was knighted in 1933 by King George V. At that time he was admiralty director of naval construction.

Naval building operations ran into serious difficulty when it became impossible recently to secure the necessary amounts of copper and steel. Efforts to buy 2,600,000 pounds of copper found no dealers bidding for the contract, while only about twenty-five per cent of the amount of steel required was covered by bidders. This reluctance on the part of metal producers has been attributed to the Walsh-Healy Act which provides that all Government contracts over $10,000 shall be let only with firms which have adopted the specified minimum hours and maximum wages for employees.

The enactment of legislation to carry out a thirty-three million dollar housing program at military posts throughout the country has been urged by Representative Cole of Maryland, who suggested that a companion bill to the Sheppard bill be presented to the House.

The Secretary of War, Mr. Woodring, has requested the Congress to change the name of the Chemical Warfare Service of the Army to the "Chemical Service" because the existing title gives a "false impression as to the primary functions of this service." The Secretary stated also that the word "warfare" should be deleted "because it is redundant and not in keeping with the titles of other arms and services." The bill effecting this change was passed by the Senate on February 11th.

Additional facilities to provide better ammunition storage at Camp Stanley, Texas, and Savanna Ordnance Depot, Ill., would be authorized by a proposed bill submitted to Congress by the War Department. New magazines costing $1,014,286 would be constructed at Camp Stanley and $1,364,550 would be spent at Savanna for similar purposes.

The steadily increasing importance of the Infantry School at Fort Benning as a training center in the United States Army, has resulted in the assignment of additional troops to that station. The 15th Ordnance Company (Maintenance) now on duty at Fort Hoyle, Md., will be detailed on permanent duty at Fort Benning to assist in the upkeep and repair of the new types of tanks which are in use at the post in the training of officers of the Army in this new and growing branch of military science. The new company will be commanded by Maj. John B. Bellinger.

AOA

Book Reviews

WAR MEMOIRS OF DAVID LLOYD GEORGE. VOL. V. Boston: Little, Brown & Company. 1936.

THIS is a work which has been so well publicized before its release in book form that reviews are now somewhat redundant. We all recall the burst of feeling last October when Mr. Lloyd George's criticism of General Pershing was made public; and who has not been following eagerly the installments of these memoirs in one of the country's largest newspaper syndicates?

Like the other volumes which appeared earlier in this series, it contains documents, data, and opinions of importance and interest hitherto unrevealed to the public. Its high lights are the outlook for 1918: the belligerents state their peace terms, Bolshevism conquers Russia; the problem of man power; Clemenceau; the military position; extension of the British front; the March retreat and the American armies in France.

To American readers, most interest in this volume probably centers in the attack on General Pershing and the caustic comments on America's war effort. The latter is characterized as "not worthy of the reputation which American business men have deservedly won for smartness, promptitude and efficiency," and marked with bungling and delay of the kinds which constantly seem to arise "when military or naval officials try to take in hand what is essentially a commercial operation." Parenthetically, I might observe that the author fails to show by what divine dispensation politicians always succeed in what they undertake, whether it be military, naval, or commercial matters.

Mr. Lloyd George's bitter comments on the part played by the United States in the war may have had their genesis in the fact that he was not able to control our diplomats and generals to the same degree that he was able to influence those from some other countries. Be that as it may, he is only slightly less bitter in his characterizations of Clemenceau, Foch, Sir Henry Wilson, Lord Haldane, Sir Douglas Haig, Sir William Robertson, Colonel Repington, and many others. But President Wilson he says "was saturated with the American distrust and suspicion of Europe."

It must be remembered that during this period Mr. Lloyd George was Prime Minister. There was no one to restrict his initiative. He was free to follow his opportunistic nature. In his memoirs now he presents his case. Quite naturally he wants the verdict of history to be favorable to his conduct, actions, and decisions. Whether the facts have been fully stated and given the proper perspective are tasks for the historian. Mr. Edwin C. Hill, writing in his "Human Side of the News" but recently commented on this volume of memoirs by saying, "Lloyd George is a special pleader, always has been and always will be. He is strong on rhetoric and often weak on facts or blind to them. His failings are those of a politician, and he has spent his life being a politician."

R. M.

NEUTRALITY; ITS HISTORY, ECONOMICS AND LAW. TODAY AND TOMORROW. By Philip C. Jessup. New York: Columbia University Press. 1936.

THIS is the fourth volume of a series covering the origins, history, economics and laws of neutrality. It treats of the present status of thought along the lines of neutrality and attempts to gaze into the future to decipher what may be the pathway of neutral nations in the next war. The project under which these volumes have been produced was planned and has been directed by a committee of the Columbia University faculty which, under

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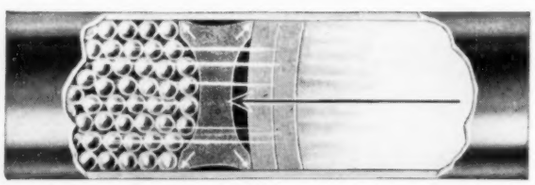

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the chairmanship of Professor Philip C. Jessup, included such authorities on this subject as Professors Angell, Chamberlain, Deak, Hyde, and Shotwell.

Probably at no time in the history of this country has the United States been so widely imbued with the idea that we must keep out of future wars. But the neutral status is no bed of roses, nor is its adoption and maintenance a simple question. Basically, of course, it is deciding the fundamental question of whether or not one will be a belligerent, but that fundamental issue is complicated by all sorts of problems involving law, economics, commerce, unconscious assistance to one or the other belligerent, ability to maintain the neutral status, possible entanglement on the side of the belligerent least deserving of support, and last but not least, what will be the status of the neutral, politically, economically, financially, and commercially, after the war.

Neutrality has its problems, not only for those who would be neutral, but also for those who are the belligerents—what neutral rights can be respected without damage, what countries must be kept neutral, to what extent neutral commerce must be curbed and many others which might be cited. The World War is still so fresh in the minds of many of us that we can recall instances in which the decision as to what was neutral and what was not involved many thorny aspects.

Selfishness, unconsciously or otherwise, usually enters into these decisions. Let me quote one instance cited by Professor Jessup: "The British exports of cocoa to Scandinavia from January to May, 1915, were 14,504,013 pounds, or a little over 7000 tons. The British in that period, therefore, supplied Scandinavia, which they considered an entrepôt for Germany, with the base for some 420 tons of nitroglycerin."

Professor Jessup concludes, and rightly so, that "no further comment is necessary."

This is a most timely book. Written by an acknowledged authority, it tells its story and imparts its information in a fashion which is neither unduly long nor technical. It tells what neutrality is, what the many proposals really are, what is practical in the way of neutrality, what has happened to us in the past in this pursuit of nonparticipation in war, and what might happen in the future.

I commend this book—and the others in this series—to all individuals who wish to have in one book or set of books, a worth while summary of neutrality. Professor Jessup and his associates are to be congratulated on the merit of this series and of the fourth volume in particular. R. M.

THE NAVAL MEMOIRS OF ADMIRAL OF THE FLEET, SIR ROGER KEYES—SCAPA FLOW TO THE DOVER STRAITS, 1916-1918. New York: E. P. Dutton & Co., Inc. 1935.

"APART from questions of design, it is no use pretending that the Battle of Jutland was not a bitter disappointment to naval officers of my generation, and it is not helpful to a younger generation to gloss over and make excuses for failures." This frank expression of opinion is typical of Admiral Keyes' revelatory description of Jutland and the other naval activities of the later years of the World War. In his first volume he condemned in no uncertain terms the evacuation of Gallipoli. Here, in addition to a vivid and unreserved account of the greatest naval battle of the war, the Admiral shows the progressive steps leading to the ending of the German submarine menace, and the crowning achievement of his war career in planning and executing the raid on Zeebrugge.

Few active leaders of the World War have written with equal bluntness, and none has surpassed Admiral Keyes in self-expression. Furthermore, the wealth of incident and the considerable detail in describing the influence of matériel on naval operations make this a book of outstanding importance to the readers of ARMY ORDNANCE. "Naval Memoirs" shows us a leader who preferred action to a policy of waiting and who preferred to defeat

the submarine menace, not by fruitless sacrifice of man power in the mud of Passchendaele, but by offensive naval operations. It is a stimulating and exciting book. D. A.

THE BATTLE OF JUTLAND. By Holloway H. Frost. Annapolis, Md.: United States Naval Institute. 1936.

WHO won the battle of Jutland? That is still one of the most controversial questions of the World War and it can be argued with many valid reasons in the affirmative by both the British and the Germans. However, here is a book which sets forth all the known facts in the case, with intelligent comments and discussions, and in such simple, nontechnical language that even a landlubber can read and understand it. With this description of that momentous conflict digested, one can make his own decision as to who won the battle.

The book is in reality a history of the naval operations of the World War up to and including this battle. The details of the fight are matters of historic record. The numerous maneuvers of the two forces and their many components are too voluminous to be even sketched within the limits of a review. The author's comments on the two forces and their leaders, and his conclusions on the results of the conflict are significant and must be noted. He says, "As between Jellicoe and Scheer, we believe in general that Jellicoe executed a poor conception of war excellently, while Scheer executed an excellent conception of war poorly. Jellicoe had skill, but as the Spartan said, 'Skill that cannot fight is useless.' Scheer had personality and could fight, but was deficient in skill. Jellicoe was a McClellan; Scheer was a Blücher without his Gneisenau." Again, he says, "Scheer . . . was a fighting admiral, no hot-headed impetuous Nelson, but an icy, calm U. S. Grant."

One of the first points that must be realized by any student of this conflict is the rather astonishing fact that Jellicoe and the British Admiralty were in accord that when the British Grand Fleet and German High Seas Fleet should meet, the conflict must be so waged by the British as "to leave nothing to chance." This accord prompts Commander Frost to observe, "Personally, we believe that the whole attitude of the British Navy had changed since the days of Drake, Hawke, Jervis, Nelson, and Cornwallis. Then it was young; now it had grown old. In the old days, England was a small country fighting for its place in the sun. Its policy was aggressive. Its statesmen, soldiers, and sailors were willing to take their chances. When they won, they doubled the stakes and gambled again. Now, the British Empire covered the globe. Its task was not to get more, but to hold what it had. Its national policy was defensive, rather than offensive." As might be expected after that, Jellicoe is criticized somewhat sharply for his failure to wipe out the German Fleet.

This is the last book to come from the pen of this brilliant naval officer who, although but forty-six years of age when he died, had achieved an enviable record as an officer and a naval historian. Before his untimely death in 1935, the author had substantially completed this text. The work was finished by Edwin A. Falk, the author's friend of many years, and a naval historian of high standing in his own right. The finished work deserves our highest commendation and must be read by all who really wish to know the story of the battle of Jutland. The excellence of this carefully developed, impartial, and convincing analysis of the many factors that made this naval engagement turn out as it did, serves only to make one regret all the more the untimely death of this brilliant officer and historian. R. M.

PEARY. By William Herbert Hobbs. New York: The Macmillan Company. 1936.

WHILE Peary's fame as the discoverer of the North Pole is now secure and he needs no herald to proclaim him great, it is surprising how soon he has been all but forgotten by the average student, to say nothing of the average man. The author, himself a polar explorer, has done the average student and the casual

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reader a great service in restating the salient facts in the lamentable Peary-Cook controversy which was the chiefest sorrow of a great man's life.

The author is now a professor emeritus of geology at the University of Michigan. His thirty-three chapters give a complete picture of him who explored the "realms of the boreal pole" of which ancient Greek philosophers and Church Fathers perhaps dreamed, and which now, thanks to Peary, are almost as well known as Alaska Territory.

The polar exploration was only one of the episodes of Peary's varied and interesting life. The book carries us from Peary's early days to the end, and gives full details of the unfortunate controversy which embittered Peary's life and made Cook the hero of a day, soon to be eclipsed by Peary's real glory and transcendent genius. The history of the controversy is, of course, the most interesting part of the book, and the story of Peary's many-sided activities will afford the reader both instruction and entertainment.

If ever there was a case of woeful misunderstanding, Peary's was that case. No explorer of whom we know ever had the experience that Peary did; few men have known such poignant sorrow or have earned such lasting fame as the hero of this interesting memoir J. M. D.

Roots of America. By Charles Morrow Wilson. New York: Funk & Wagnalls Company. 1936.

THE newspaper reader, the radio listener, the man on the street —even the "forgotten man"—and all others read, hear, and see a great deal about the American system, America's manifest destiny and many other things American. One wonders, sometimes, for whom this system is being maintained, who will suffer if it is changed or destroyed, who will work out the country's manifest destiny, and above all, who will pay the inevitable price for all these things. The answer, of course, is—the American people. But who are the American people? Mr. Wilson gives at least a partial answer to this question in his interesting and fascinating "Roots of America".

Described as a travelogue of American personalities, the author says, "it merely offers a series of factual pictures of American types and trades which the writer believes to be basic to our land." The series includes a Vermont farmer, a Missouri corn planter, a small-town hotel keeper, an Arkansas editor, a plantation owner in the St. Francis River basin, a sign painter of the Ozarks, and so on through a dozen or more types, trades and occupations.

Types, the author calls these characters as he portrays them, but nevertheless they all have a great deal of individuality. In general, they have one virtue in common—they have weathered prosperity and depression with their own unaided efforts. And it is refreshing to find so many diverse types who, in this day and age, are proud to be able to stand on their own feet without the aid of some paternal governmental official or bureau.

This is a comforting sort of a book because Mr. Wilson brings out that these, the people of the United States, although they differ materially in their nature and outlook, all appreciate thrift and are endowed with a great share of native philosophy and good old common horse sense. He believes, too, that these people are more interested in the coming and going of good seasons, seed time and harvest, than they are in new political doctrines, economic theories, or perhaps even the New Deal.

No review of this book would be complete without appreciative mention of the thirty-odd illustrations which adorn its pages. Reproduced from actual photographs, they cover a wide range of appropriate subjects, including the various types discussed in the text. Some of them are masterpieces of the photographer's art.

Altogether, Mr. Wilson is to be congratulated for the reassuring picture he paints of the "Roots of America." R. M.

APACHE AGENT. By Woodworth Clum. Boston: Houghton Mifflin Company. 1936.

HAD all Indian agents been like John P. Clum and had all the Indians in the Southwest been like the Arivaipa Apaches, the story of our Indian relations would have been vastly different. It would have been a page of history that would have reflected credit on any nation. It would not have been the story of a period called a "century of dishonor."

John P. Clum, whose biography this book essentially is, became an Indian agent among the Apaches on the San Carlos agency in 1874 when he was 23. He served in that capacity only about three years, but in that time he indicated beyond question how the Indian problem might be solved. His method was essentially a common-sense application of the "Golden Rule." He treated his Indian charges fairly and honestly. He did not lie to them but rather took them into his confidence. He saw that they got what they were supposed to get and he effectively kept them well behaved through a corps of Apache police which he organized from among their own numbers. His methods and treatment earned his Indians' respect, friendship, and loyalty. Clum's control over his Indians and his impartial administration of Indian laws are indicated by the firmness which he displayed in leading a band of his Apache police some 400 miles from San Carlos to Ojo Caliente to capture Geronimo. Note that he captured Geronimo; he did not receive Geronimo's surrender.

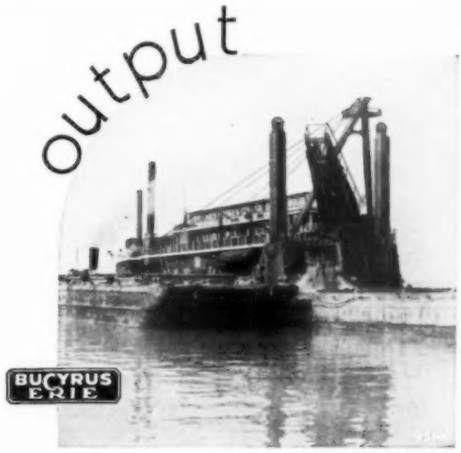
The lack of foresight and policy displayed by the Federal Government in its control of Indian matters, is, perhaps, no better illustrated than by the circumstances under which Clum became an Indian agent, and by the Government's action on his recommendations with respect to Geronimo. Despite Clum's success in managing the San Carlos reservation, his recommendations concerning Geronimo were ignored. Clum was convinced that Geronimo was a bad Indian, a murderer and a menace to peaceful Indian relations. It was his opinion that Geronimo should be tried and hanged. But the Government, in one of its moods of soft sentimentalism, did not even keep the captured Indian bandit in confinement. It is estimated that Geronimo's raids between 1881 and 1886 cost 500 lives and some twelve million dollars before he finally was rounded up and properly secured.

In this book of nearly three hundred pages, only a little more than one hundred pages are devoted to Mr. Clum's activities as an Indian agent, and the first one hundred pages are devoted to an account of the Indian troubles in the Southwest from 1835. The book is therefore more than a biography of one John P. Clum and it is more—much more—than just a story of a successful Indian agent. It portrays the history of a section of the West and the Southwest during its most glamorous period. It has historical value because it is based on first-hand accounts and writings of those hardy characters who were the leading actors in the winning of this section of America. Mr. Woodworth Clum deserves our appreciation and commendation for the clever manner in which he has presented this historical matter in such a readable form—for it is readable, and thrillingly so. R. M.

A GENIUS IN THE FAMILY. By Hiram Percy Maxim. New York: Harper & Brothers. 1936.

THE name of Maxim suggests either of two things to those interested in ordnance—the Maxim machine gun which has been and still is so popular in many countries, and the Maxim silencer. It so happens that Sir Hiram Stevens Maxim was the inventor of the machine gun while his son Hiram Percy Maxim, the author of this book was the inventor of the silencer. The elder Maxim died years ago; the author passed on in 1936 before the book was published, althougth the manuscript had been accepted.

Sir Hiram Stevens Maxim could be quite humorous at times and his pranks caused many persons with whom he came in contact a great amount of embarrassment. Yet with all the



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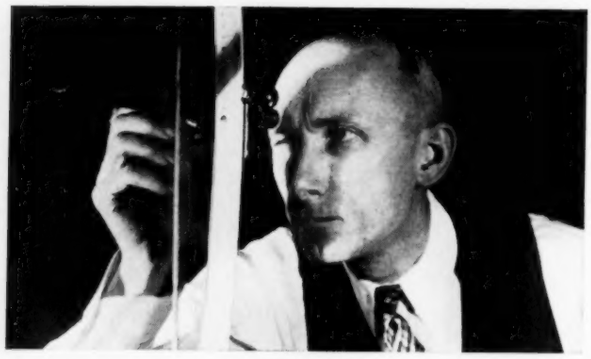

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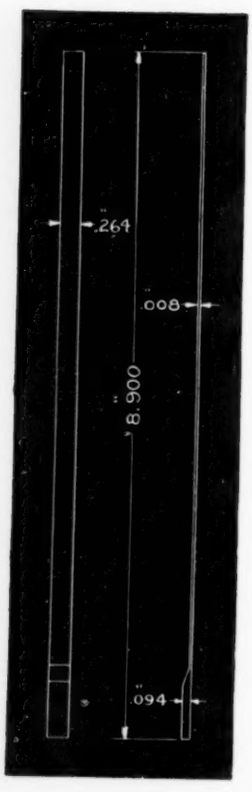

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idiosyncrasies outlined by the author, Sir Hiram succeeded in giving his young son a sound foundation for engineering training. The methods used to accomplish this end will cause many a laugh.

Young readers will appreciate the many things that transpired during the lifetime of Hiram Percy Maxim, for in this book he has set forth the amazing happenings in the Maxim household from the beginning to the end. The action begins when the son (the author) begins life in the Maxim household as the first-born. He admits that his father knew nothing about being a father—but then what father *does* know a great deal about this complicated subject when there is a first-born? It has to be learned. That Sir Hiram learned cannot be denied, but the amusement he provided and the method of instruction he used with Percy are most unique.

To enumerate the many incidents would only spoil the anticipation of the reader. It can be said, however, that from the time Sir Hiram made use of a two-headed penny to the last chapter wherein he blows black beans at the Salvation Army in London, the book is most interesting. How he had to be withdrawn from his pleasure of blowing beans makes an appropriate finis to what this reviewer truthfully can class as the most unique and comical book he has read in many a month. H. E. S.

MEN, MONEY & MOLECULES. By William Haynes. Garden City, N. Y.: Doubleday, Doran & Co., Inc. 1936.

WAR and love are not the only sources of romance. Industry and the progress of civilization provide quite as fertile sources for that which thrills the mind and stirs the imagination. "When the chemical manufacturer makes rayon, lacquers and high explosives out of the fuzz that clings to the cotton seed or turns black sticky smelly coal tar into a scarlet dye, the perfume of the heliotrope, or the useful medicine aspirin", he is merely exhibiting some of the romance that is included in the story of the progress of commercial and industrial chemistry which has taken place in little more than a century and, some of the more spectacular—or might we say, miraculous—achievements, within the memory of the present generation.

Within the limits of this 200-page book, the author has presented a brief picture of the development of commercial and industrial chemistry from the viewpoint both of the growth of applied science and of the development of an industry.

To the casual man in the street the American chemical industry is something which has grown, mushroom-like, since the date of the revelations of the German coal-tar secrets during the World War. It will, therefore, be news to many to learn that the American chemical industry had its birth in Boston only fifteen years after the Mayflower dropped anchor off Plymouth Rock; that at the time of the World War the annual output of this industry was valued at two billion dollars, being exceeded in value only by food stuffs, textile and

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steel products, and that at the present time the mill town of Pawtucket, Rhode Island, consumes more chemicals than does all of South America.

Mr. Haynes devotes a chapter to the part played by nitric acid, phenol, and acetone in the World War, the steps taken to provide these essentials of munitions in sufficient quantities during 1914-1918, and the developments which, after the Armistice, preserved these industries for peace-time purposes.

In addition to depicting briefly, but nevertheless sufficiently completely, the story of chemistry's development and applications to industry, the author describes the organization, growth, and method of operation of the outstanding chemical companies of the United States and Europe. His discussion of the economics of chemistry is well worth the reading.

Although the book is filled to overflowing with facts and figures, it is exceedingly readable because of the romance and drama in the story and because the story is well told. R. M.

FRANZ: A DOG OF THE POLICE. By Maj. S. P. Meek, U. S. Army. Philadelphia: The Penn Publishing Company.

THIS is the latest boys' book from the pen of Major Meek. It was written while he was stationed at the Ordnance Depot in Hawaii. It is the story of a Dobermann Pinscher who was trained for police work in the famous C. A. Roy Kennels of Berkeley, Calif. The dog is purchased by the Berkeley Police Department and soon gains a state-wide reputation for the excellence of his work. When officials from the Berkeley force are sent to Honolulu to reorganize the department there, Franz goes with them and in the tropical city of Honolulu adds to his already great reputation and gathers fresh laurels for himself and his master.

Major Meek has proved himself in recent years to be an energetic and capable Ordnance Officer. He has served in many important capacities and is now stationed at San Francisco. As a writer of boys' books he is achieving a reputation for which he is also to be highly commended. There is excellent precedent for such an avocation because celebrities no less than Maj. Gen. Paul Malone and Brig. Gen. Hugh Johnson have done likewise. Major Meek is following in the footsteps of these officers and as a writer of captivating boys' stories is achieving a well-deserved reputation. F. G. F.

Pamphlets Received

NICKEL ALLOY STEEL Bulletin P-1. The Properties and Applications of Heat-Treated Wrought Nickel Alloy Steels (in sections up to 6 inches in diameter or thickness). An aid to the selection of suitable steels to meet modern industrial demands in product and plant equipment. The International Nickel Company. 1936.

THE AAC 37-MM. AIRCRAFT CANNON. A description of the characteristics and functions of a new weapon for aircraft armament. The American Armament Corporation. 1936.

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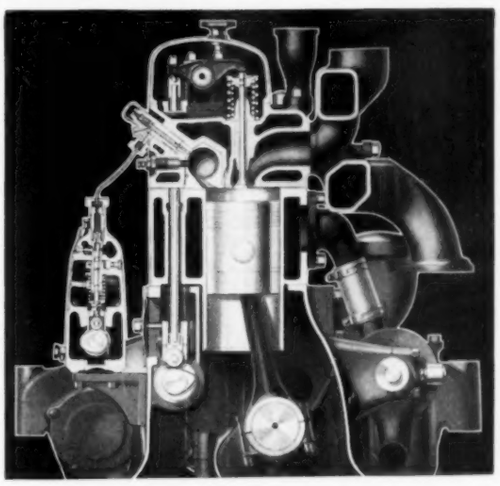

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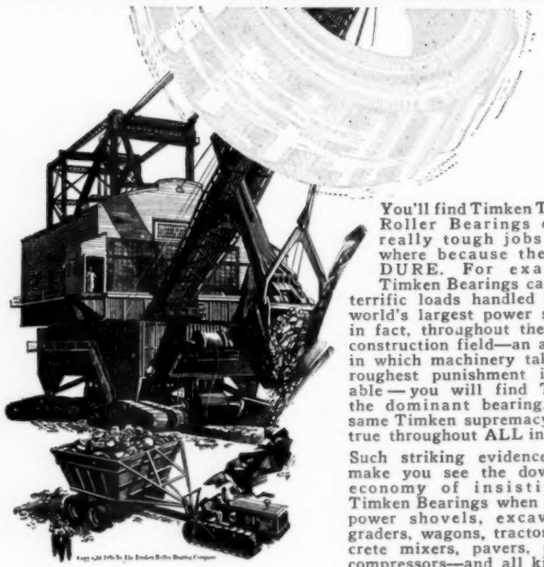

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THE ANNUAL MEETING

ARMY ORDNANCE ASSOCIATION

MAY 12 AND 13, 1937

On the evening of Wednesday, May 12, 1937, at seven o'clock, the annual banquet of the Army Ordnance Association will be held at the Mayflower Hotel in the City of Washington. At this first session of the Eighteenth Annual Meeting the Association will confer upon Maj. Gen. James G. Harbord, soldier, engineer, and administrator, its Gold Medal for Distinguished Ordnance Service. In addition to the medalist, the meeting will be addressed by Hilaire Belloc, Esq., renowned English military historian and commentator.

In the afternoon of the following day, Thursday, May 13th, the second session of the Annual Meeting will be held at the Aberdeen Proving Ground, Maryland, from two until four o'clock. Members of the Association are invited to attend at this time to witness an exhibition of Ordnance equipment. The program will emphasize the design and production engineering of the matériel shown. There will be no firings. Ladies will not be admitted. The Proving Ground will be open, by invitation to members, at one-thirty o'clock.